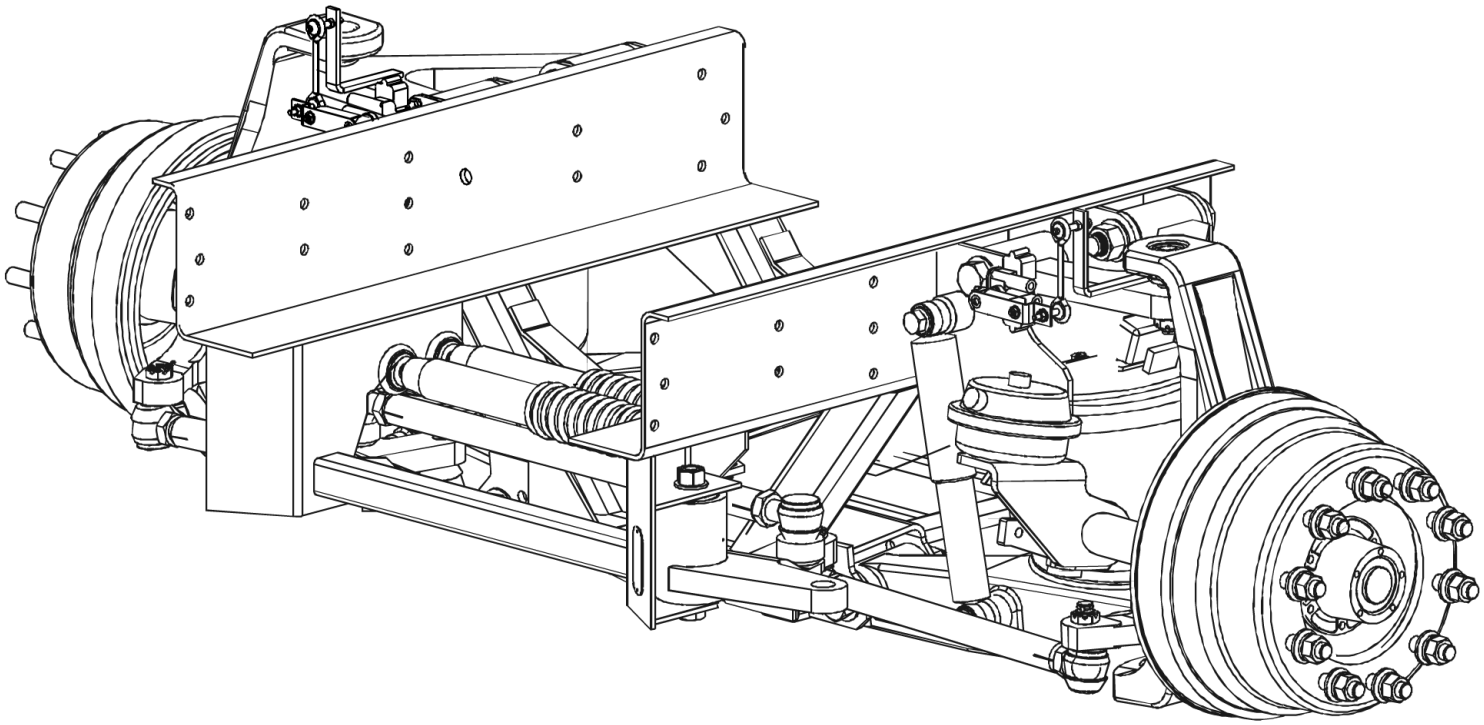
Reyco Granning SUSPENSIONS

Motorhome Suspensions **Owner's Manual**

IFS1200/1320/1370

| Independent Front Suspension

Maintenance Instructions
Service Parts



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COMPANY PROFILE

Reyco Granning Suspensions was formed by the merger and acquisition of two well-known names in the heavy-duty vehicle suspension industry: Reyco and Granning.

Reyco grew out of the Reynolds Mfg. Co. and was first known as a major supplier of brake drums for heavy-duty vehicles, and later developed a full line of air and steel spring suspensions for trucks, busses, trailers, and motorhomes.

Granning Air Suspensions was founded in 1949 in Detroit, Michigan as a manufacturer of auxiliary lift axle suspensions. Granning later became an innovator of independent front air suspensions for the motorhome industry.

Reyco Granning LLC was formed in early 2011 through a partnering of senior managers and MAT Capital, a private investment group headquartered in Long Grove, Illinois.

Reyco Granning manufacturing facilities are certified to the ISO9001:2008 standards, a globally recognized assurance that quality standards have been established and are maintained by regular rigorous audits.

Service Notes

This Service Manual describes the correct service and repair procedures for the ReycoGranning® IFS1200/1320/1370 Independent Front Suspension.

The information contained in this manual was current at the time of printing and is subject to change without notice or liability.

You must follow your company safety procedures when you service or repair the suspension. Be sure you read and understand all the procedures and instructions before you begin work on the suspension.

Granning uses the following types of notes to give warning of possible safety problems and to give information that will prevent damage to equipment.

⚠ WARNING

A warning indicates procedures that must be followed exactly. Serious personal injury can occur if the procedure is not followed.

⚠ CAUTION

A caution indicates procedures that must be followed exactly. Damage to equipment or suspension components and personal injury can occur if the procedure is not followed.

NOTE

A note indicates an operation, procedure or instruction that is important for correct service.

Some procedures require the use of special tools for safe and correct service. Failure to use these special tools when required can cause personal injury or damage to suspension components.

ReycoGranning® Air Suspensions reserves the right to modify the suspension and/or procedures and to change specifications at any time without notice and without incurring obligation.

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Section 1
Introduction

Introduction

ReycoGranning® Air Suspensions has developed this service manual to aid in the maintenance of ReycoGranning's® Independent Front Suspensions installed on Spartan Motors chassis. These suspensions incorporate the latest in design and manufacturing technologies. The suspensions have been designed and tested to provide improved ride and handling compared to I-beam type axles.

Overloading the suspension may result in adverse ride and handling characteristics.

Model	Capacity
IFS1200-SP[1]	12,000 lbs.
IFS1200-SP[2]	12,000 lbs.
IFS1200-S2[2]	12,000 lbs.
IFS1200S-SB[2,3]	12,000 lbs.
IFS1200S2[2]	12,000 lbs.
IFS1200S2-SB[2,3]	12,000 lbs.
IFS1320-SP[1]	13,200 lbs.
IFS1320-HP[2]	13,200 lbs.
IFS1370-HP[2]	13,700 lbs.
IFS1370S-SB[2,3]	13,700 lbs.

[1] Stud Piloted Wheels
[2] Hub Piloted Wheels
[3] Sway Bar Equipped

Identification

The suspension model and serial number are stamped on an aluminum tag that is riveted to the driver side steering arm mount on the subframe assembly. (See Figure 2). The serial number is used by ReycoGranning® for control purposes and should be referred to when servicing the suspension. (See Figure 1).

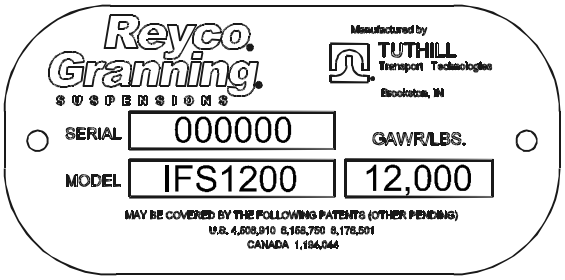


Figure 1: Suspension Identification

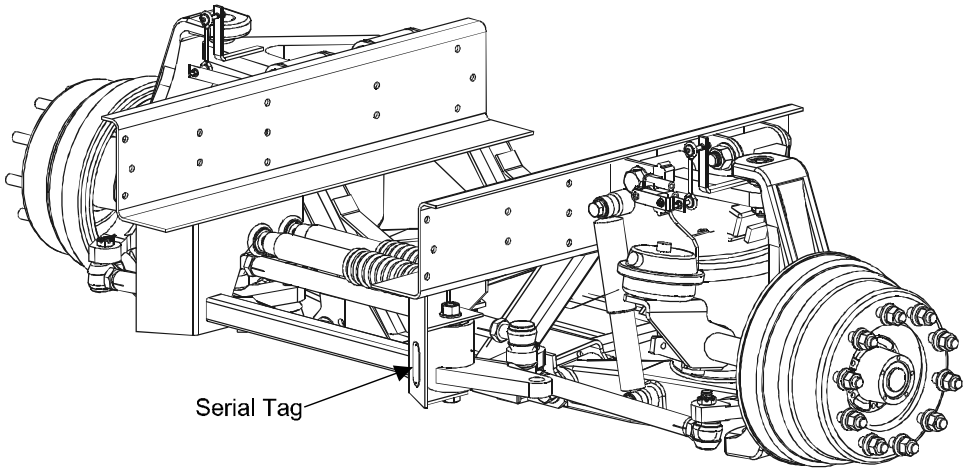


Figure 2: Suspension Identification Location

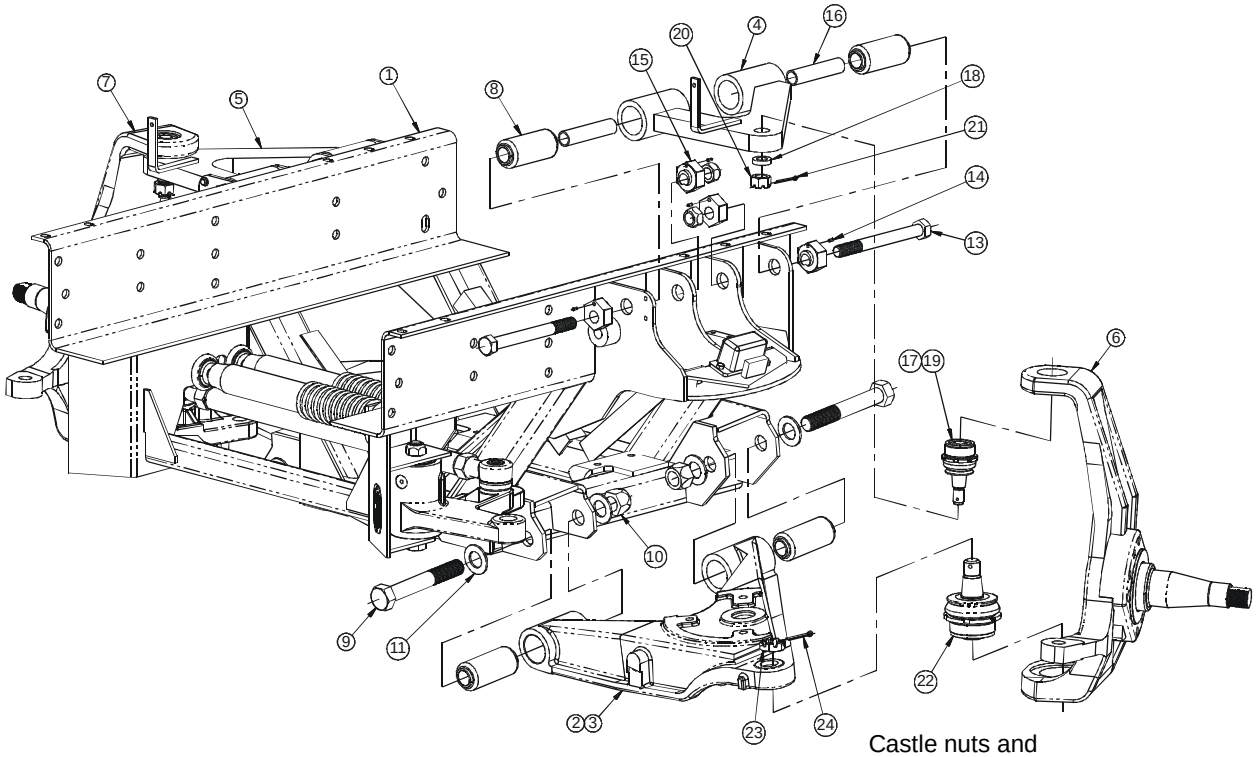
Section 1
Introduction

Description—Structural Components

Item	Part No.	Description	Item	Part No.	Description
1	7257	Subframe Assembly (Non-Sway Bar units)	13	292	Hex Head Bolt, 7/8"-9 x 8.5", Gr. 8
	702906-01	Subframe Assembly (Sway Bar units)	14	293	Socket Set Screw, #10-24 x .38"
2	8757	Lower Control Arm Assembly, LH	15	702897-01	Eccentric Boss
3	8756	Lower Control Arm Assembly, RH	16	8490	Bushing Sleeve Spacer
4	7260	Upper Control Arm Assembly, LH	17	6975	Upper Ball Joint (Press In)
5	7261	Upper Control Arm Assembly, RH	18	291	Hardended Flat Washer, 3/4"
6	8745	Steering Knuckle Assembly, LH (IFS1200)	*	*K705382*	*Kit, Ball Joint (40mm)*
	8747	Steering Knuckle Assembly, LH (IFS1200S2 / IFS1320 / IFS1370)	19	705382-01	- Ball Joint (40mm) (Thread In)
7	8744	Steering Knuckle Assembly, RH (IFS1200)	20	705382-02	- Castle Nut, M30 x 1.5
	8746	Steering Knuckle Assembly, RH (IFS1200S2 / IFS1320 / IFS1370)	21	705382-03	- Cotter Pin, 1.50 x .15 Dia.
8	8382	Bushing	*	*K705383*	*Ball Joint Kit (65mm)*
9	165	Hex Head Bolt, 1 1/8"-12 x 7 1/2", Gr. 8	22	705383-01	- Ball Joint (65mm)
10	166	Lock Nut, 1 1/8"-12, Gr. C	23	705383-02	- Castle Nut, M24 x 1.5
11	168	Hardened Flat Washer, 1 1/8"	24	705383-03	- Cotter Pin, 1.95 x .24 Dia.
12	100122-P1	Lock Nut, 7/8"-9, Gr. C			

Note: The IFS1200 may be equipped with either Press In style or Thread In style Upper Ball Joints (Items 17 & 19). When ordering replacement parts, please note which style is installed in your suspension.

*Ball Joint kits for service use. The kits' subcomponents may not be ordered individually.



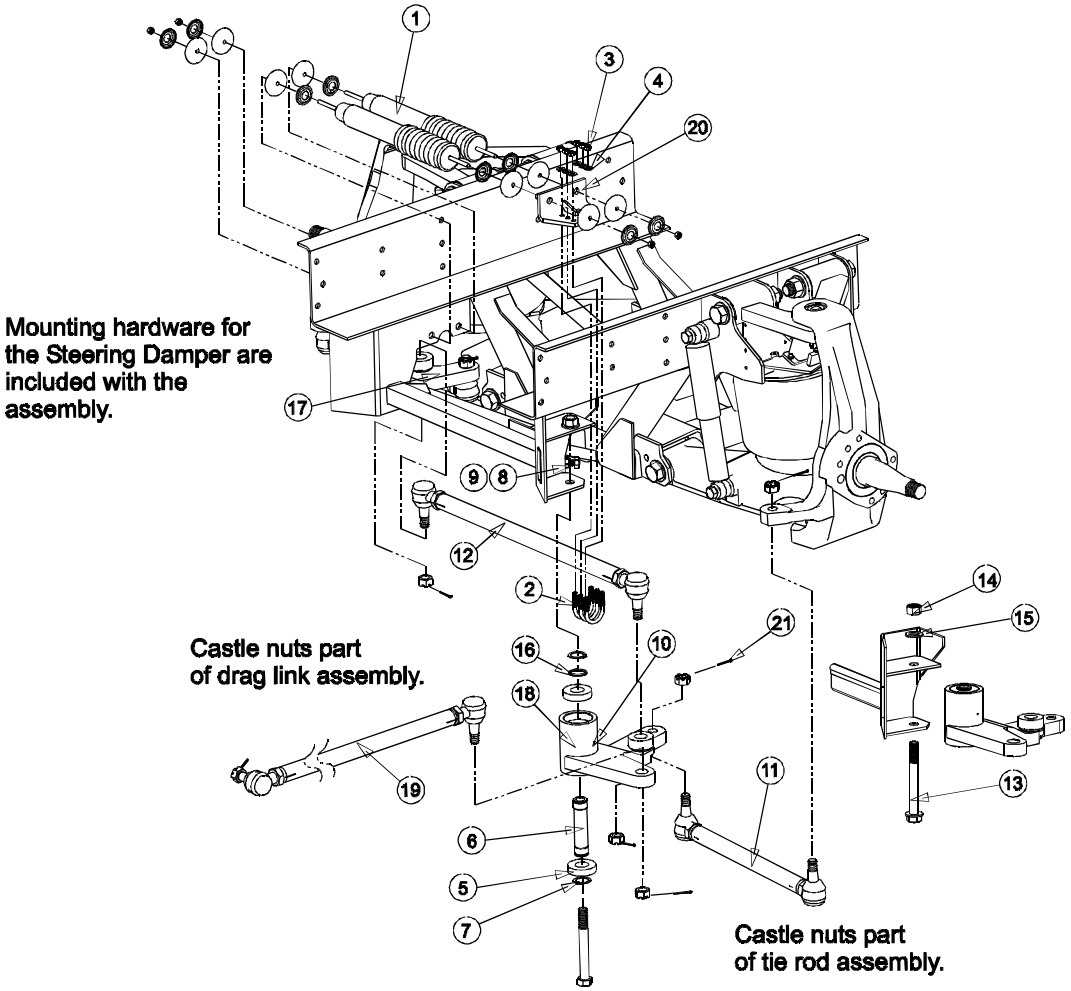
Castle nuts and Cotter Pins are part of the Ball Joint Kit.

Section 1
Introduction

Description—Steering Components

Item	Part No.	Description	Item	Part No.	Description
1	7780	Steering Damper Assembly	13	89430596	Hex Head Bolt, 7/8”-9 x 7-1/2”, Gr. 8
2	701546-01	U-Bolt, 3/8”-24, Gr. 5	14	100122-P1	Lock Nut, 7/8”-9, Gr. C
3	89422298	Lock Nut, 3/8”-24, Gr. 8	15	102354-P1	Hardened Flat Washer, 7/8”
4	263	Hardened Flat Washer, 3/8”	16	8611	Shim
5	7332	Bearing	17	8089	Idler Arm
6	7271	Sleeve	18	8090	Bell Crank
7	7331	Snap Ring	19	7256	Drag Link Assy, 31 3/8” L – See Note Below
8	8223511	Steering Stop Bolt, 5/8”-11 x 1 1/2”, Gr. 8		7948	Drag Link Assy, 43 3/8” L – See Note Below
9	100276-P1	Steering Stop Jam Nut, 5/8”-11, Gr. 5		8277	Drag Link Assy, 45 1/4” L – See Note Below
10	7352	Grease Fitting		8355	Drag Link Assy, 39 7/8” L – See Note Below
11	7254	Outer Tie Rod Assembly	20	701748-01	Steering Damper Mount Bracket Assembly
12	7638	Relay Rod Assembly	21	101445-P1	Cotter Pin, 1/8 x 1-1/2

Note: The IFS1200 may be equipped with various length drag links depending on the chassis front overhang. Measure length of drag link when ordering replacement parts.


Mounting hardware for the Steering Damper are included with the assembly.
Castle nuts part of drag link assembly.
Castle nuts part of tie rod assembly.

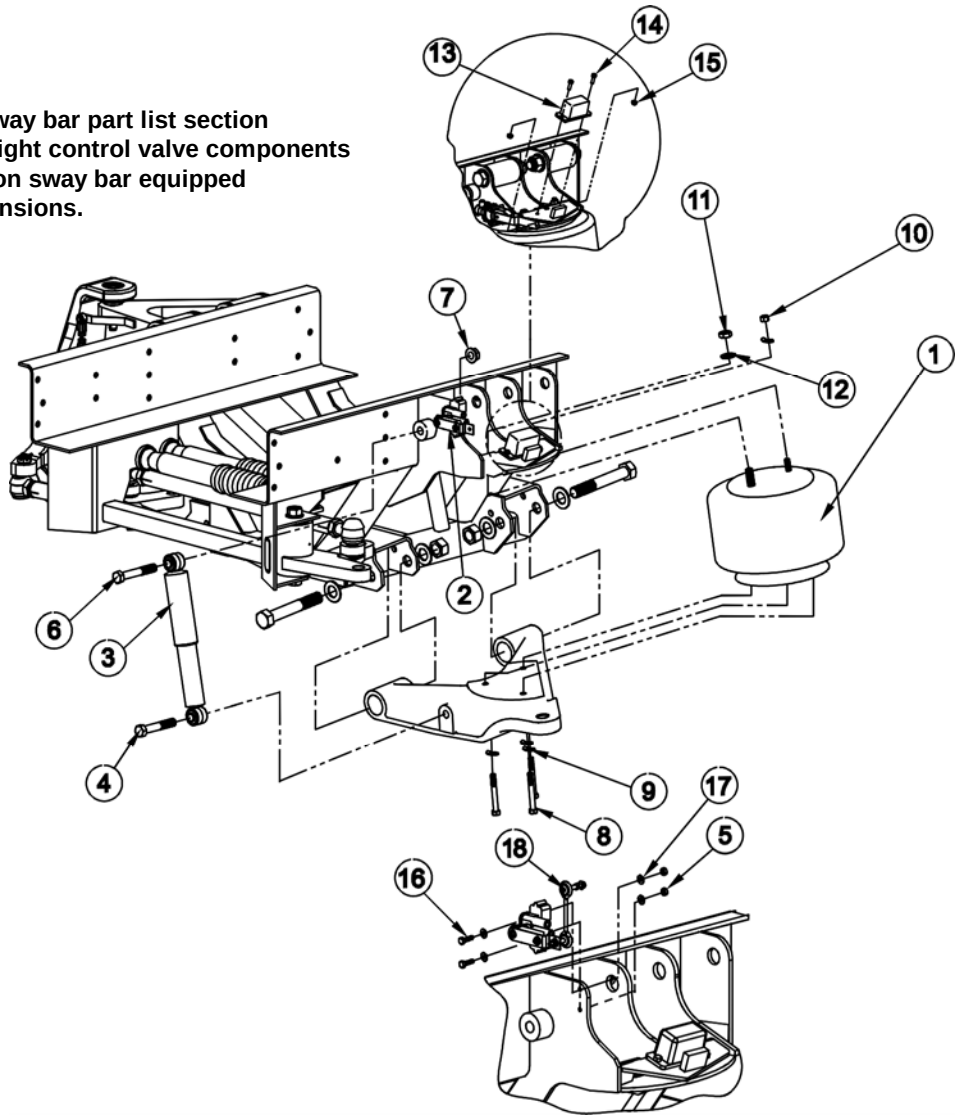
Section 1
Introduction

Description—Air Spring and Shock Absorber Assy.

Item	Part No.	Description	Item	Part No.	Description
1	7593	Air Spring Assembly (IFS1200)	9	8103323	Lock Washer, 1/2"
	703667-01	Air Spring Assembly (IFS1200S2)	10	8120378	Hex Nut, 1/2"-13, Gr. 5
	700136-01	Air Spring Assembly (IFS1370)	11	8219758	Jam Nut, 3/4"-16, Gr. 5
2	8295	HCV* and Linkage Assy. (Ridewell)	12	8131017	Flat Washer, 3/4"
	8451	HCV* Assy., Left, (Hadley)	13	7327	Rebound Stop
	8452	HCV* Assy., Right, (Hadley)	14	100507-P1	Hex Head Bolt, 5/16"-18x1", Gr. 8
	8718	HCV* Assy., (Neway)	15	8273802	Serrated Flange Nut, 5/16"-18, Grade G
3	8257	Shock Absorber (IFS1200)	16	230	Hex Head Bolt, 1/4"-20x3", Gr. 8 (Hadley)
	8643	Shock Absorber (IFS1370)		100702-P1	Hex Head Bolt, 1/4"-20x1", Gr. 8 (Neway)
4	100678-P1	HHB 3/4-10 x 3.50" Gr. 8 ZN	17	8120392	Flat Washer, 1/4"
5	100703-P1	Lock Nut, 1/4"-20, Gr. C	18	701747-01	Height Control Valve Linkage Assy, (Hadley)
6	701671-01	HHB 3/4-10 x 4.50" Gr. 8 ZN		8719	Height Control Valve Linkage Assy, (Neway)
7	208	LFN 3/4-10 Gr. G			
8	700049-01	Hex Head Bolt, 1/2"-13 x 4.25", Gr. 5(IFS1200)			
	700137-01	Hex Head Bolt, M12-1.75 x 110,Gr. 10.9(IFS1370)			

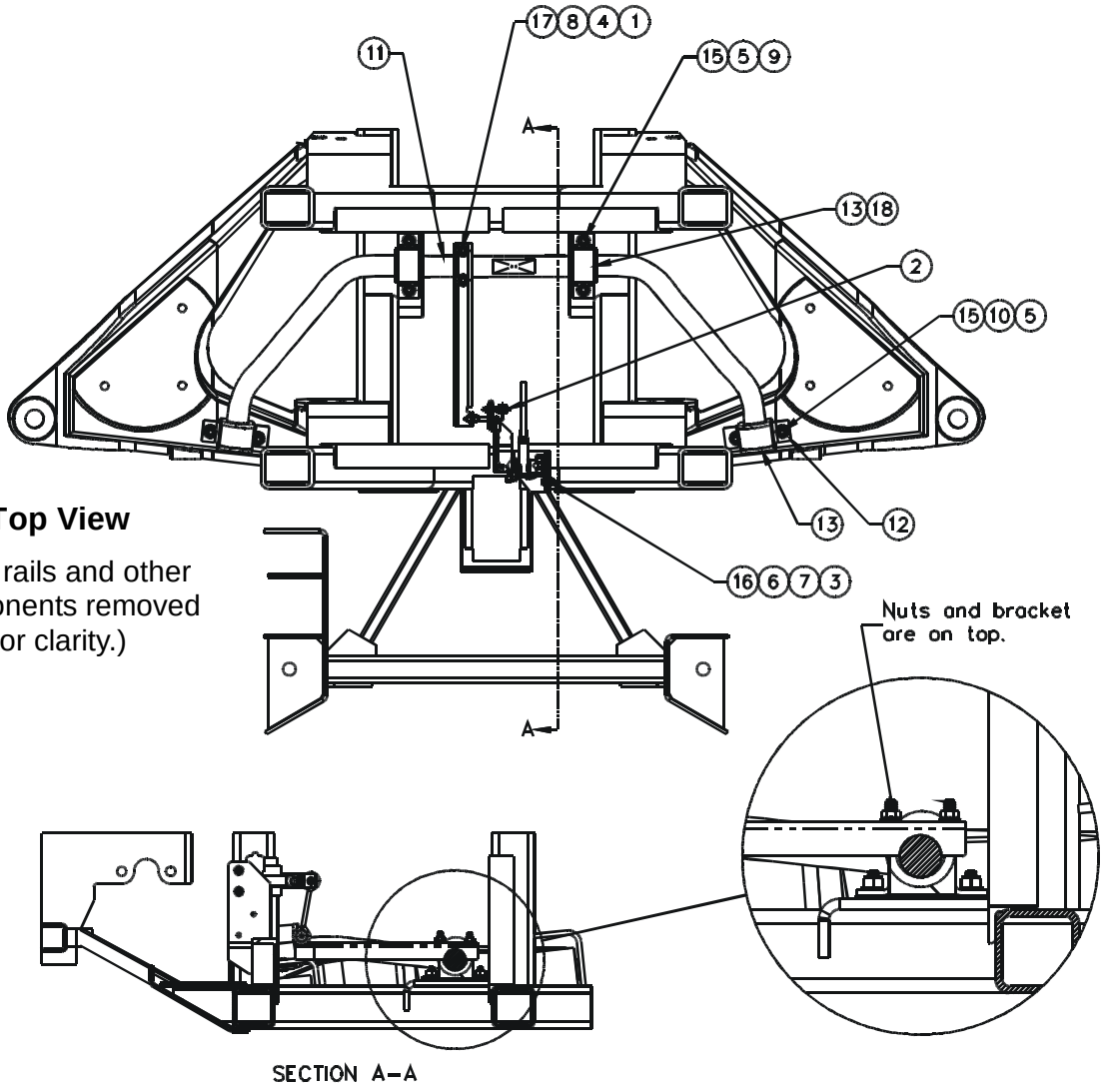
* HCV: Height Control Valve

Note: See sway bar part list section for height control valve components used on sway bar equipped suspensions.



Section 1
Introduction

Item	Qty.	Part No.	Description	Item	Qty.	Part No.	Description
1	2	263	HFW 3/8 .406x.812x.065	10	4	702797-02	HHB 7/16-14 x 1.5 Gr. 8 ZP
2	1	8719	Linkage, HCV	11	1	702892-01	Sway Bar
3	4	8120392	FW 1/4 .281x.625x.065 ZP	12	4	702894-01	Mount, D-Ring, Sway Bar
4	2	89422298	LN 3/8-24 Gr. 8	13	2	702895-01	Bushing, Solid, Sway Bar
5	8	89422299	LN 7/16-14 UNC Gr. 8	14	2	702895-02	Bushing, Split, Sway Bar
6	2	100702-P1	HHB 1/4-20x1 Gr. 8 ZN	15	8	702898-01	Washer, Sway Bar
7	2	100703-P1	LN 1/4 Stover Gr. 8 Plated	16	1	703286-01	HCV w/ Smaller Dead band
8	1	701546-01	U-Bolt	17	1	703356-01	Arm, HCV
9	4	702797-01	FHB 7/16-14x1.25 Gr. 8 ZP	18	1	TC197	Aqua Shield Grease Sway Bar



Top View

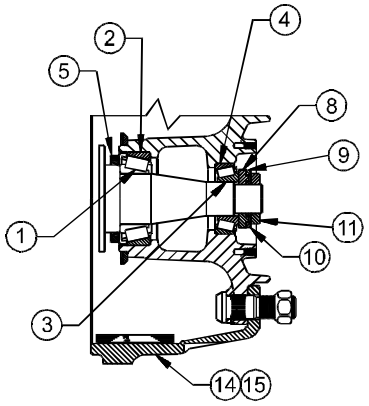
(Side rails and other components removed for clarity.)

INSTALL SWAY BAR WITH
UNIT AT RIDE HEIGHT

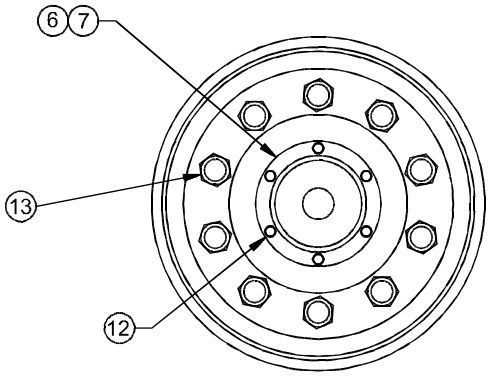
Section 1
Introduction

Description—Wheel End Components

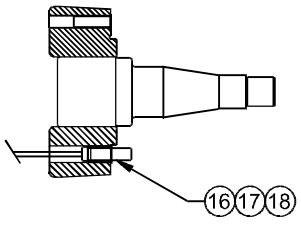
Item	Part No.	Description	Item	Part No.	Description
1	1784	Inner Bearing Cone	14	705015-01	Hub and Drum Assembly, LH and RH, Hub Piloted, 15x4 Brakes (IFS1200-HP)
2	N/A	Inner Bearing Cup		6942	Hub and Drum Assembly, LH, Stud Piloted, 15x4 Brakes (IFS1200-SP)
3	6972	Outer Bearing Cone		705088-01	Hub and Drum Assembly, Hub Piloted, 16.5x5 Brakes, LH and RH (IFS1320, 1370-HP)
4	N/A	Outer Bearing Cup		8494	Hub and Drum Assembly, LH, Stud Piloted, 16.5x5 Brakes (IFS1320, 1370-SP)
5	7977	Hub Seal	15	6943	Hub and Drum Assembly, RH, Stud Piloted, 15x4 Brakes (IFS1200-SP)
6	1779	Hub Cap (IFS1200, 1320, 1370-SP)		8493	Hub and Drum Assembly, RH, Stud Piloted, 16.5x5 Brakes (IFS1320, 1370-SP)
	700017-01	Hub Cap (IFS1200, 1320, 1370-HP)	16	7328	ABS Sensor
7	1786	Hub Cap Gasket (IFS1200, 1320, 1370-SP)	17	7329	ABS Bushing
	700024-01	Hub Cap Gasket (IFS1200, 1320, 1370-HP)	18	6946	ABS Spring Retainer
8	6967	Inner Spindle Nut			
9	6968	Spindle Lock Washer			
10	6969	Spindle Washer			
11	6970	Outer Spindle Nut			
12	266	Hub Cap Bolt, 5/16"-18 x 3/4", Gr. 5			
13	N/A	Lug Nut (refer to Hub and Drum)			



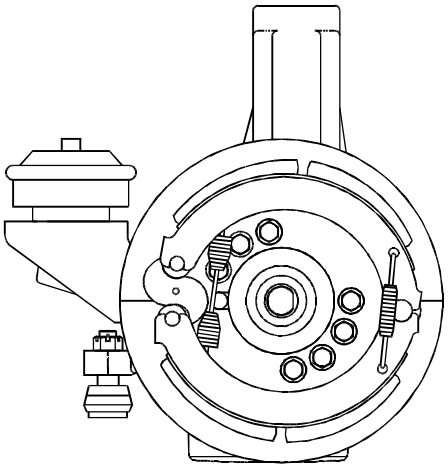
Wheel End Assembly



Wheel End



ABS Components



Brake Assembly Components
(See Service List on Next Page)

Section 1
Introduction

Description—Wheel End Service Part List

Description	Model	ReycoGranning® P/N	Recommended Vendor	Vendor P/N
Wheel End Components				
Inner Bearing Cone	Both	1784	Timkin	HM 212049
Inner Bearing Cup	Both	N/A	Timkin	HM 212011
Outer Bearing Cone	Both	6972	Timkin	3782
Outer Bearing Cup	Both	N/A	Timkin	3720
Hub Seal & Axle Ring	Both	7977	Stemco (Gardian)	308-0836
Inner Spindle Nut	Both	6967	Rockwell (or Euclid)	1227-L-194 (E-2299)
Spindle Lock Washer	Both	6968	Rockwell (or Euclid)	1229-G-475 (E-2297)
Spindle Washer	Both	6969	Rockwell (or Euclid)	1229-F-474 (E-2298)
Spindle Outer Nut	Both	6970	Rockwell (or Euclid)	1227-B-106 (E2296)
Hub Cap(Stud Pilot)	IFS1200, IFS1320-SP	7324	Dual Dynamics	DG-6PS
Hub Cap(Hub Pilot)	IFS1320-HP	7483	Dual Dynamics (Stemco)	DG6-F4.5S (343-4024)
Hub Cap(Hub Pilot 705015-01 and 705088-01 Hub and Drum Assy)	Many	1779	Stemco	343- 4009
Hub Cap Gasket(Stud Pilot)	IFS1200, IFS1320-SP	8377	Stemco	330-3122
Hub Cap Gasket(Hub Pilot)	IFS1320-HP	N/A	Stemco	330-3024
Hub Cap Gasket(Hub Pilot 705015-01 and 705088-01 Hub and Drum Assy)	Many	1786	Stemco	330-3009
Hub and Drum Components				
LH Hub & Drum Assy.(Stud Pilot 15x4 Brake)	IFS1200-SP	6942	Dayton Walther, Webb	15-15556-059, 1521FKZKLT-10
Hub & Drum Assy.(Hub Pilot 15x4 Brake)	IFS1200-HP	7784	Dayton Walther	15-15632-305,
Hub & Drum Assy.(Hub Pilot 15x4 Brake)	IFS1200-HP	705015-01	Webb	25291JK4T-10
LH Hub & Drum Assy.(Stud Pilot 16.5x5 Brake)	IFS1320, 1370-SP	8494	Dayton Walther	15-15556-111
RH Hub & Drum Assy.(Stud Pilot 15x4 Brake)	IFS1200-SP	6943	Dayton Walther, Webb	15-15556-058, 1521FKZKRT-10
RH Hub & Drum Assy.(Stud Pilot 16.5x5 Brake)	IFS1320, 1370-SP	8493	Dayton Walther	15-15556-110
Hub & Drum Assy.(Hub Pilot 16.5x5 Brake)	IFS1320, 1370-HP	8456	Dayton Walther	15-15632-167
Hub & Drum Assy.(Hub Pilot 16.5x5 Brake)	IFS1320, 1370-HP	705088-01	Webb	25201G54T-10
LH Hub Assy.(Stud Pilot)	IFS1200, IFS1320-SP	8881	Dayton Walther, Webb	05-15556-003, 1521F--PLT
RH Hub Assy.(Stud Pilot)	IFS1200, IFS1320-SP	8880	Dayton Walther, Webb	05-15556-002, 1521F--PRT
Hub Assy.(Hub Pilot)	IFS1320-HP	8882	Dayton Walther	05-15632-004
Brake Drum 15x4(Stud Pilot)	IFS1200	8639, 8376	Dayton Walther, Webb	85-123382-002, 65541B
Brake Drum 16.5x5(Hub Pilot)	IFS1320-HP	8642	Dayton Walther	85-123370-002
Brake Drum 16.5x5(Stud Pilot)	IFS1320-SP	8641	Dayton Walther	85-123383-002

Section 1
Introduction

Description—Brake Service Part List

Description	Model	ReycoGranning® P/N	Recommended Vendor	Vendor P/N
ABS Components				
ABS Sensor	Both	7328	Rockwell-Wabco	441 032 900 0
ABS Bushing	Both	7329	Midland	101328-AB
ABS Spring Retainer	Both	6946	Rockwell Wabco	899 760 510 4
XL15x4 Brake Components (prior to June 1999 Mfg. Date)				
LH Brake Assy., 15x4 *	IFS1200	8315	Dana	150WD126-5
RH Brake Assy., 15x4 *	IFS1200	8316	Dana	150WD126-6
Brake Relining Kit(Shoe & Lining Asy and Spring Kit;1 Side)	IFS1200	8300	Dana	150KB129X
S-Cam Seal and Bushing Kit(1 Side)	IFS1200	N/A	Dana	150KB100 X
Spring Kit(1 Side)	IFS1200	N/A	Dana	150KB101 X
Dust Shield Kit(1 Side)	IFS1200	N/A	Dana	150KB102 X
S-Cam Roller & Spring Kit(1 Side)	IFS1200	N/A	Dana	150KB106 X
S -Cam Roller, Spring, & Lining Kit(1 Side)	IFS1200	N/A	Dana	150KB115 X
RH S-Camshaft	IFS1200	N/A	Dana	150WK103 5
LH S-Camshaft	IFS1200	N/A	Dana	150WK102 5
Air Chamber Assy.(Type 16)	IFS1200	N/A	Dana	150WR115 1
Automatic Slack Adjuster	IFS1200	N/A	Dana	150WR105 2
XL16.5x5 Brake Components (prior to June 1999 Mfg. Date)				
LH Brake Assy., 16.5x5 *	IFS1320	8407	Dana	165WD389-3
RH Brake Assy., 16.5x5 *	IFS1320	8408	Dana	165WD389-4
Brake Relining Kit(Shoe & Lining Asy and Spring Kit;1 Side)	IFS1320	8645	Dana	165WN126-4X
S-Cam Seal and Bushing Kit(1 Side)	IFS1320	N/A	Dana	165KB100X
Spring Kit(1 Side)	IFS1320	N/A	Dana	150KB116X
S-Cam Roller & Spring Kit(1 Side)	IFS1320	N/A	Dana	150KB117X
RH S-Camshaft	IFS1320	N/A	Dana	165WK111-5
LH S-Camshaft	IFS1320	N/A	Dana	165WK110-5
Air Chamber Assy.(Type 20)	IFS1320	N/A	Dana	165WR130-1
Automatic Slack Adjuster	IFS1320	N/A	Dana	165WR136-1

* Components no longer available. Replace with ES assemblies.

ES1504D 15x4 Brake Components				
LH Brake Assy., 15x4	IFS1200	703957-01	Dana	329464
RH Brake Assy., 15x4	IFS1200	703957-02	Dana	329465
Brake Relining Kit(Shoe & Lining Asy and Spring Kit;1 Side)	IFS1200	700036-07	Dana	N/A
S-Cam Seal and Bushing Kit(1 Side)	IFS1200	700036-05	Dana	127808
S-Cam Roller & Spring Kit(1 Side)	IFS1200	700036-06	Dana	326514
RH S-Camshaft	IFS1200	N/A	Dana	974683
LH S-Camshaft	IFS1200	N/A	Dana	974682
Air Chamber Assy.(Type 20)	IFS1200	N/A	Dana	974840
Automatic Slack Adjuster	IFS1200	N/A	Dana	819471
ES1655D 16.5x5 Brake Components				
LH Brake Assy., 16.5x5	IFS1320	703958-01	Dana	329466
RH Brake Assy., 16.5x5	IFS1320	703958-02	Dana	329467
Brake Relining Kit(Shoe & Lining Asy and Spring Kit;1 Side)	IFS1320	700033-07	Dana	N/A
S-Cam Seal and Bushing Kit(1 Side)	IFS1320	700036-05	Dana	127808
S-Cam Roller & Spring Kit(1 Side)	IFS1320	700033-06	Dana	808330
RH S-Camshaft	IFS1320	N/A	Dana	808709
LH S-Camshaft	IFS1320	N/A	Dana	808708
Air Chamber Assy.(Type 20)	IFS1320	N/A	Dana	165WR130-1
Automatic Slack Adjuster	IFS1320	N/A	Dana	819472

Section 1
Introduction

Tow Point Locations

If a vehicle is disabled and needs to be towed by the front end to a service center, the towing apparatus may be attached to the suspension subframe in the designated locations, as shown in Figure 3. The towing apparatus should be attached securely for safe towing. The towing apparatus may not be connected to any subframe area or suspension component other than that shown in Figure 3. Connecting to other subframe areas or suspension components can result in suspension damage or disconnection of vehicle while being towed.

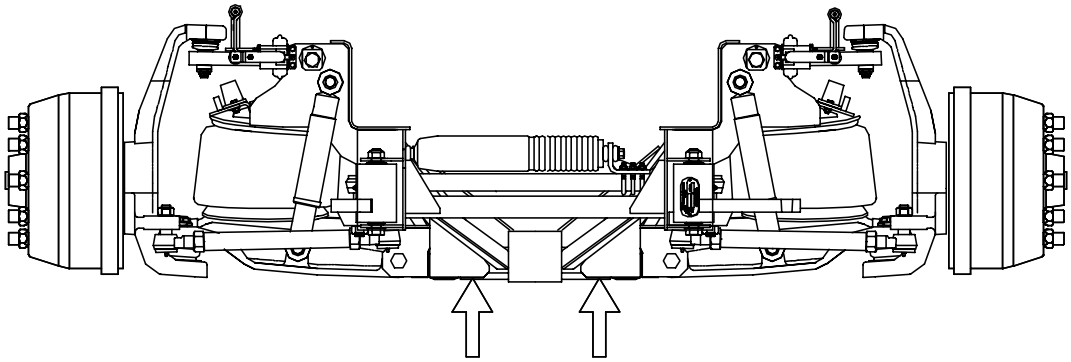


Figure 3: Tow Point Locations

Section 2
Troubleshooting

Suspension System--General

SYMPTOMS	POSSIBLE CAUSES	REMEDIES
Tires wear out quickly or have uneven tire tread wear. Note: Wear pattern will indicate possible cause(s). Consult tire manufacturer for guidance.	1) Tires have incorrect pressure. 2) Tires out of balance. 3) Incorrect toe-in setting. 4) Incorrect ride height. 5) Incorrect rear axle alignment. 6) Incorrect steering arm geometry. 7) Improper(mismatched) tires and wheels.	1) Put specified air pressure in tires. 2) Balance or replace tires. 3) Adjust toe-in to specified setting. 4) Adjust ride height to specified setting. 5) Align rear axle to specified thrust angle. 6) Adjust tie rod lengths as required. 7) Install correct tire and wheel combination.
Vehicle is difficult to steer.	1) Improper oversized tires. 2) Tires not uniform. 3) Tires have incorrect pressure. 4) Incorrect steering arm geometry. 5) Steering arms binding. 6) Ball joints binding. 7) Tie rod ends binding. 8) Steering column linkage binding. 9) Steering miter box binding. 10) Steering gear valve binding. 11) Steering damper binding or malfunction. 12) Steering wheel to column interference. 13) Power steering pump fluid level low and possible leak in system. 14) Power steering pump pressure and flow below specification. 15) Air in power steering system. 16) Contaminated or incorrect fluid. 17) Obstruction within steering gear or lines. 18) Excessive internal steering gear leakage.	1) Install correct tire and wheel combination. 2) Install correct tire and wheel combination. 3) Put specified air pressure in tires. 4) Adjust tie rod lengths as required. 5) Check steering arm bearings and lubricate as needed. 6) Inspect ball joints for wear and replace as required. 7) Inspect tie rod ends for wear and lubricate as needed. 8) Align or adjust as required. 9) Check steering miter box and repair or replace as required. 10) Inspect, repair or replace as required. 11) Check and replace as needed. 12) Align or adjust as required. 13) Add fluid, tighten connections and correct as needed. 14) Conduct pump flow and relief pressure tests and adjust , repair or replace as needed. 15) Add fluid, tighten connections and bleed system. 16) Replace with correctly specified fluid. 17) Inspect, remove obstruction(s) and repair or replace as required. 18) Inspect, repair or replace as required.

Section 2
Troubleshooting

Suspension System--General (Cont'd)

SYMPTOMS	POSSIBLE CAUSES	REMEDIES
Vehicle wanders side to side-loose steering. Steering wheel has large amplitude, rotational oscillations when hitting large bumps.	1) Vehicle overloaded or unevenly loaded.	1) Check wheel loads and correct as needed.
	2) Improper(mismatched) tires and wheels.	2) Install correct tire and wheel combination.
	3) Incorrect toe-in setting.	3) Adjust toe-in to specified setting.
	4) Tires have incorrect pressure.	4) Put specified air pressure in tires.
	5) Loose steering gear mounting.	5) Check mounting and secure as needed.
	6) Tie rod end connection loose or ball stud worn.	6) Inspect ball stud connections and wear.
	7) Loose wheel nuts.	7) Check and tighten to specification.
	8) Ball joints binding or worn.	8) Inspect ball joints for wear or contamination and replace as required.
	9) Steering column linkage worn.	9) Check for wear and repair or replace as needed.
	10) Wheel bearings out of adjustment.	10) Check wheel bearing end play and adjust as required.
	11) Steering gear adjustment.	11) Check and adjust to specification.
	12) Steering column misaligned.	12) Realign steering column as required.
	13) Steering damper binding or malfunction.	13) Check and replace as needed.
	14) Steering arm mounts loose.	14) Check and tighten to specification.
Vehicle pulls to one side without the brakes applied.	1) Improper(mismatched) tires and wheels.	1) Install correct tire and wheel combination.
	2) Tires have incorrect pressure.	2) Put specified air pressure in tires.
	3) Vehicle unevenly loaded.	3) Check wheel loads and correct as needed.
	4) Improper brake adjustment.	4) Inspect, adjust and correct as required.
	5) Incorrect rear axle alignment.	5) Align rear axle to specified thrust angle.
	6) Unequal ride height side to side.	6) Inspect ride height and adjust to specified setting.
	7) Wheel bearings out of adjustment.	7) Check wheel bearing end play and adjust as required.
	8) Loose steering gear mounting.	8) Check mounting and secure as needed.
	9) Tie rod end connection loose or ball stud worn.	9) Inspect ball stud connections and wear.
	10) Bent spindle or steering arm.	10) Inspect and replace as required.
	11) Frame or underbody out of alignment.	11) Inspect and correct as required.
	12) Incorrect toe-in setting.	12) Adjust toe-in to specified setting.
	13) Misaligned belts in radial tires.	13) Check and replace as needed.
	14) Steering gear valve binding.	14) Inspect, repair or replace as required.
	15) Steering gear not centered.	15) Inspect and adjust as required.
	16) Excessive internal steering gear leakage.	16) Inspect, repair or replace as required.
	17) Incorrect caster and/or camber setting.	17) Install and/or adjust eccentric adapters in upper control arm.

Section 2
Troubleshooting

Suspension System--General (Cont'd)

SYMPTOMS	POSSIBLE CAUSES	REMEDIES
Vehicle pulls to one side with the brakes applied.	1) Grease, oil or dirt on brake linings.	1) Replace brake linings as required.
	2) Brake linings are glazed.	2) Deglaze brake linings or replace as required.
	3) Brake linings are not a balanced set, different friction codes or lining brand.	3) Replace brake linings as required.
	4) Loose or broken brake linings.	4) Replace brake linings as required.
	5) Brake drum out of round.	5) Re-machine brake drum as required.
	6) Defective brake drum.	6) Inspect for defects and replace as required.
	7) Brake air chamber clevis pin or camshaft binding.	7) Check and lubricate as needed.
	8) Defective slack adjuster.	8) Inspect for defects and replace as required.
	9) Uneven brake adjustment side to side.	9) Adjust slack adjuster as required.
	10) Different brake air chamber size or slack adjuster length side to side.	10) Replace with same size brake air chambers and length slack adjusters.
	11) Air pressure uneven side to side.	11) Check side to side air pressure and correct as needed.
	12) Unequal brake air chamber stroke side to side.	12) Check side to side stroke and adjust as required.
	13) Rear axle brakes misadjusted.	13) Check and adjust as required.
	14) Air leak or obstruction in air brake lines.	14) Check fittings with soapy water solution and remove obstructions.
	15) Brake air chamber air leak or diaphragm damaged.	15) Check chamber for air leak and damaged diaphragm.
Vehicle rolls side to side excessively.	1) Front and/or rear shock absorbers worn.	1) Replace shock absorbers as needed.
	2) Shock mounting loose.	2) Check and tighten as required.
	3) Shock eye bushings worn.	3) Check and replace as needed.
	4) Control arm pivot bushings worn.	4) Inspect and replace as required.
	5) Internal leak in height control valve.	5) Check height control valve and replace as required.
Front tires lock up during hard braking or ABS malfunction light remains lit..	1) ABS sensor malfunction.	1) Inspect ABS sensor installation and replace sensor as required.
	2) ABS CPU or system malfunction.	2) Check and repair or replace as required.
	3) ABS sensor electrical connection faulty.	3) Check ABS sensor connection and lead wire.
	4) Tone ring on hub damaged.	4) Check for damage and replace as required.

Section 2
Troubleshooting

Suspension System--General (Cont'd)

SYMPTOMS	POSSIBLE CAUSES	REMEDIES
Vehicle ride is too harsh and/or suspension contacts stops excessively.	1) Front shock absorbers worn.	1) Replace shock absorbers as needed.
	2) Incorrect ride height.	2) Adjust ride height to specified setting.
	3) Vehicle overloaded.	3) Check wheel loads and correct as needed.
	4) Air spring supply lines leaking or obstructed.	4) Check air line connections and remove obstructions.
	5) Vehicle system air pressure below specification.	5) Check air pressure and correct as needed.
	6) Rebound bumper worn or missing.	6) Check and replace as needed.
	7) Jounce bumper in air spring worn or broken.	7) Check and replace air spring as required.
Vehicle ride is too soft.	1) Front shock absorbers worn.	1) Replace shock absorbers as needed.
	2) Incorrect ride height.	2) Adjust ride height to specified setting.
Vehicle has unequal turning radius right to left.	1) Incorrect steering arm geometry.	1) Adjust tie rod lengths as required.
	2) Steering gear not centered.	2) Inspect and adjust as required.
	3) Steering gear poppet valves set incorrectly.	3) Check wheel turn angles and adjust as required.
Suspension does not maintain ride height.	1) Air leak.	1) Check connections with soapy water solution and repair or replace as needed.
	2) Internal leak in height control valve.	2) Check height control valve and replace as required.
	3) Height control valve linkage loose.	3) Check and tighten linkage as needed.
	4) Air spring chafed or worn.	4) Check air spring and replace as needed.
Brakes are noisy.	1) Grease, oil or dirt on brake linings.	1) Replace brake linings as required.
	2) Brake linings are glazed.	2) Deglaze brake linings or replace as required.
	3) Brake linings are not a balanced set, different friction codes or lining brand.	3) Replace brake linings as required.
	4) Loose or broken brake linings.	4) Replace brake linings as required.
	5) Brake drum out of round.	5) Re-machine brake drum as required.
	6) Defective brake drum.	6) Inspect for defects and replace as required.
	7) Excessive dirt build up in brake drum cavity.	7) Remove excessive dirt from brake drum cavity.

Section 3
Inspection

General Inspection

Perform a thorough visual inspection of the suspension to ensure proper assembly and to identify broken parts and loose fasteners each time the vehicle suspension is serviced. Do the following during an inspection.

- **Wheel Alignment** - Follow the guidelines in Section 5 for wheel alignment inspection intervals. Check wheel alignment if excessive steering effort, vehicle wander, or abnormal tire wear is evident.
- **Fasteners** - Check that all the fasteners are tightened to the proper tightening torque. Use a calibrated torque wrench to check torque.
- **Wear and Damage** - Inspect components of the suspension for wear and damage. Look for bent or broken components. Replace all worn or damaged components.
- **Operation** - Check that all components move freely through the complete turning arc.

CAUTION: ReycoGranning® recommends replacing any damaged or out-of-specification components. Reconditioning or field repairs of major front suspension components is not allowed.

Note: Refer to Section 1 for identification of components.

CAUTION: All cast components are heat treated. These components cannot be bent, welded, heated, or repaired in any way without reducing the strength or life of the component; voiding the warranty; and may cause a vehicle accident which can result in serious personal injury.

Checking the Ball Joint Seal and Axial End Play

Preparation

1. Set the parking brake and block the drive wheels to prevent vehicle movement.
2. Steer the front wheels straight ahead.
3. Raise the vehicle until the front wheels are off the ground. Support the raised vehicle with safety stands. Do not place jacks or safety stands under the lower control arms to support the vehicle.

WARNING: Never work under a vehicle supported by only a jack. Jacks can slip or fall over and cause serious personal injury. Always use safety stands.

4. Deflate the air springs. The air spring may be deflated by disconnecting the vertical link from the height control valve (HCV) horizontal link or the upper control arm mount and positioning the HCV horizontal link

downward. Secure the HCV link to ensure it does not move and re-inflate the air spring.

5. Remove the tires as needed for access to inspect seals and make measurements.

NOTE: Care must be taken to not damage ball joint seals during inspection. Seals that are ruptured during inspection must be replaced. Do not apply excessive force to pry ball joints.

Lower and Upper Ball Joint Seal Inspection

1. Inspect the ball joint seal outer surface for presence of oil "wetting". The entire outer seal surface should be dry. Use a mechanics mirror and flashlight to inspect the entire seal. Use a blunt object as needed to inspect between seal convolutes.
2. If oil wetting is found, then inspect the entire wet area to confirm the seal has a rupture(s) and oil source is from internal grease leaking from the ball joint. If seal is ruptured, then the ball joint must be replaced.
3. Skip ball joint end play measurement.

NOTE: Care must be taken to not damage ball joint seals during inspection. Seals that are ruptured during inspection must be replaced. Do not apply excessive force to pry ball joints.

Lower Ball Joint Axial End Play Inspection

1. Place a support under the tire or brake drum to position the suspension near its ride height. The shock length at ride height is 16.12".
2. Install a dial indicator with a magnetic base so that the base is fixed to the lower control arm. Place the indicator tip on the bottom of the lower ball joint base. (See Figure 4).

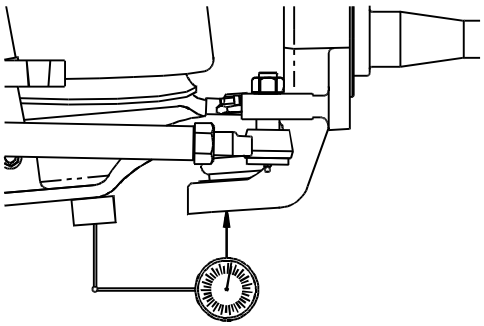


Figure 4 - Lower Ball Joint Dial Indicator Mounting

3. Using a C-clamp, squeeze the knuckle and the lower control arm together to seat the ball joint. (See Figure 5) Do not apply excessive clamp load.
4. Set the dial indicator on "zero".

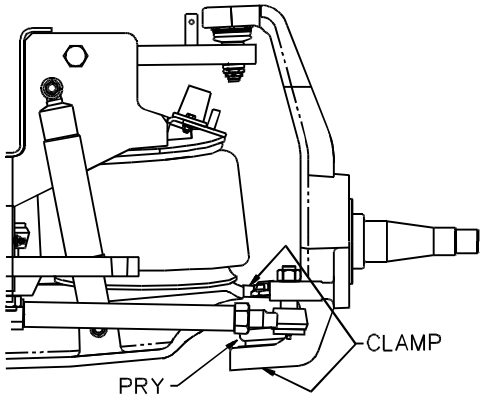


Figure 5 - Ball Joint Pry Bar Locations

0. Release the clamp. Place the pry bar between the lower control arm and steering knuckle. (See Fig. 4).

   Do not allow the pry bar to contact the ball joint seal.

1. Firmly pry downward using the steering knuckle as a fulcrum to lift the lower control arm. The pry load must not cause the tire or brake drum to be lifted off its support thus causing the suspension to change position.
2. Record the dial indicator reading. A reading greater than .040" will require ball joint replacement.
3. Inspect ball joint seal for damage and replace the ball joint if damaged during measurement process.

Upper Ball Joint Axial End Play Inspection

1. Place a support under the tire or brake drum to position the suspension near its ride height. The shock length at ride height is 16.12".
2. Install a dial indicator with a magnetic base so that the base is fixed to the upper control arm. Place the indicator tip on the bottom of the upper ball joint base. (See Figure 6).

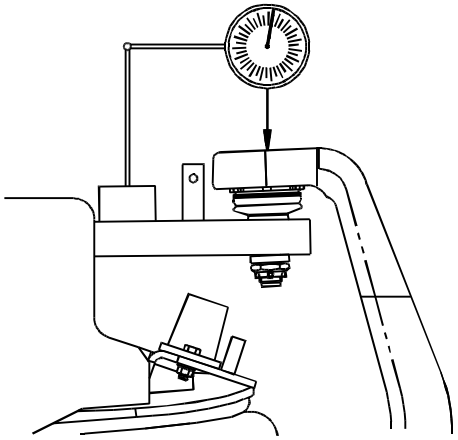


Figure 6 - Upper Ball Joint Dial Indicator Mounting

3. Using a C-clamp, squeeze the knuckle and the upper control arm together to seat the ball joint. (See Figure 7). Do not apply excessive clamp load.
4. Set the dial indicator on "zero".

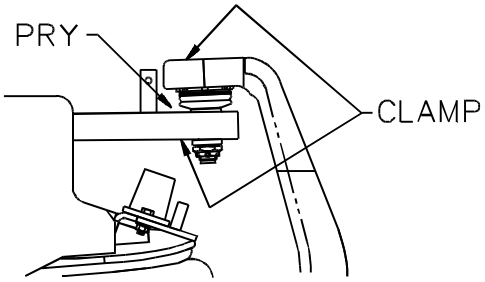


Figure 7 - Ball Joint Pry Bar Locations

5. Release the clamp. Place the pry bar between the upper control arm and steering knuckle. (See Figure 7). **Do not allow the pry bar to contact the ball joint seal.** Firmly pry downward using the steering knuckle as a fulcrum to lower the upper control arm. The pry load must not cause the tire or brake drum to be lifted off its support thus causing the suspension to change position.
6. Record the dial indicator reading. A reading greater than .040" will require ball joint replacement.

7. Inspect ball joint seal for damage and replace the ball joint if damaged during measurement process.

Checking the Control Arm Bushings for Wear

Preparation

1. Set the parking brake and block the drive wheels to prevent vehicle movement.
2. Raise the vehicle until the front wheels are off the ground. Support raised vehicle with safety stands. Do not place jacks or safety stands under the lower control arms to support the vehicle.

> ⚠ **WARNING: Never work under a vehicle supported by only a jack. Jacks can slip or fall over and cause serious personal injury. Always use safety stands.**

3. Remove the tires.

> **NOTE: If one of the bushings in a control arm is worn then both control arm bushings must be replaced. It is recommended that the bushings in all of the control arms be replaced at the same time if one is worn.**

Inspection

1. Check clearance between each control arm and subframe bushing mount. (See Figures 8 & 9). Look for contact pattern as evidence of bushing wear. Replace worn bushings in both control arm housings as needed.

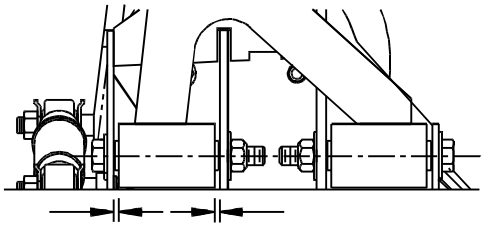


Figure 8 - Upper Control Arm Bushing Clearances

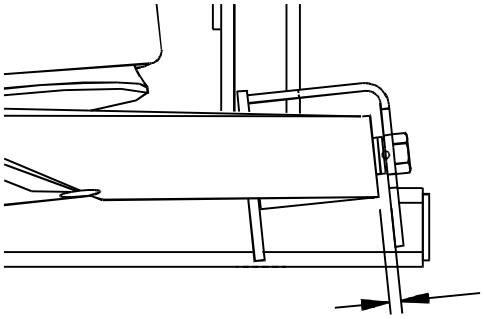


Figure 9 - Lower Control Arm Bushing Clearances

2. Check for bushing bulging between the control arm and subframe mount or presence of small rubber particles near subframe bushing mount.
3. Check that the control arm mounting bolts are tight. Recommended torque is **950-1050 lbf•ft**. on lower control arms and upper control arms without eccentric adapters installed. The recommended torque for upper control arms with eccentric adapters installed is **460-490 lbf•ft.** See Torque Table. A loose joint will result in wear between the bushing inner sleeve and subframe mount.

Section 3
Inspection

Checking the Tie Rod Ends

Preparation

1. Set the parking brake and block the drive wheels to prevent vehicle movement.

> ⚠ **WARNING: Do not use a wrench or other object to apply leverage when inspecting tie rod end sockets. Applying leverage can yield incorrect results and damage components. Component damage can lead to the loss of steering control.**

Inspection

1. With the engine on, lightly rock the steering wheel and observe any looseness in the two mating tapers or any movement of the stud nut at both ends of the tie rod. (See Figure 10). If looseness is found in either place go to step 2, otherwise skip to step 3.
2. Remove the tie rod end ball stud from the taper mount and visually inspect both. If either of the mating tapers show distortion or wear, then both components must be replaced. Torque tie rod castle nuts to **130-150 lbf•ft**. See Torque Table.
3. With the engine off and the wheels steered straight ahead, grab the tie rod near its end and try to move the socket in a direction parallel to the ball stud axis. (See Figure 10). Be sure to only apply hand pressure to the tie rod.
4. Measure the axial movement with a scale. If the movement is greater than 1/8 inch(3mm) replace the tie rod end immediately. If the socket moves but the movement is less than 1/8 inch(3mm) then the tie rod end should be replaced before 1/8"(3mm) movement occurs.
5. Check dust boot for damage. Replace as needed.

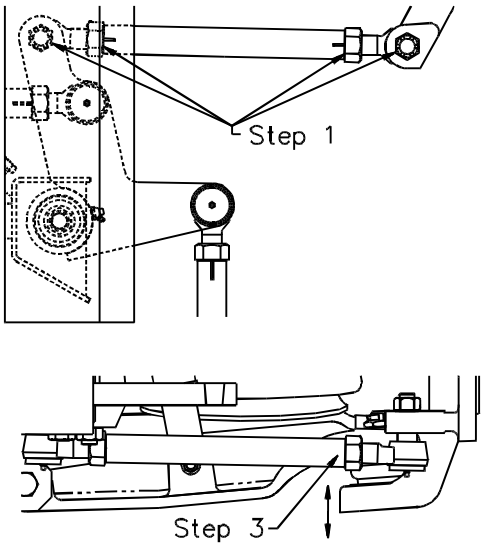


Figure 10 - Tie Rod

Checking the Automatic Slack Adjusters and Brake System

Automatic Slack Adjusters

The suspension system is equipped with Haldex brand automatic slack adjusters for steer axles. Refer to Haldex technical service guideline #485-89007 for inspection and adjustment procedure.

Brake System

The suspension system is equipped with Dana 15x4 S-cam air brakes. Refer to Dana maintenance manual #SHA 589-1 5M service procedures.

Section 3
Inspection

Checking the ABS Sensor and Tone Ring

Preparation

1. Set the parking brake and block the drive wheels to prevent vehicle movement.
2. Raise the vehicle until the front wheels are off the ground. Support raised vehicle with safety stands. Do not place jacks or safety stands under the lower control arms to support the vehicle.

> ⚠ **WARNING: Never work under a vehicle supported by only a jack. Jacks can slip or fall over and cause serious personal injury. Always use safety stands.**

3. The tires and brake drums may be removed if needed to ease inspection of tone ring and sensor.
4. Disconnect the ABS sensor lead from the chassis connector.
5. The ABS sensor test will require a volt meter which can measure AC voltage on a millivolt scale.

Inspection

1. Connect the volt meter to the connector pins of the ABS sensor lead.
2. Set the volt meter scale to millivolts and the voltage source to AC volts.
3. Rotate the wheel hub and record the voltage output from the ABS sensor. A minimum output of 800 millivolts is normal.
4. If the minimum voltage output is not achieved, check lead wire connections and repeat Step 3. Otherwise, if the minimum voltage output is not achieved after repeating step 3 then go to Step 5.
5. Check physical gap between the sensor and tone ring (See Figure 11) The brake drum must be removed to inspect gap. The maximum allowable gap is .027 inch. If the gap is greater than .027 inch, press on the wire lead end of the sensor and push the sensor into contact with the tone ring. Check that the ABS spring retainer and bushing are not unseated. Re-seat components as needed.
6. Inspect the tone ring on the hub for physical damage and proper installation onto the hub. The tone ring should have a maximum run out of .008 inch relative to the hub/spindle centerline.
7. Repeat Step 3. If voltage output is less than 800 millivolts then replace the ABS sensor (Note: Check voltage output of new sensor).

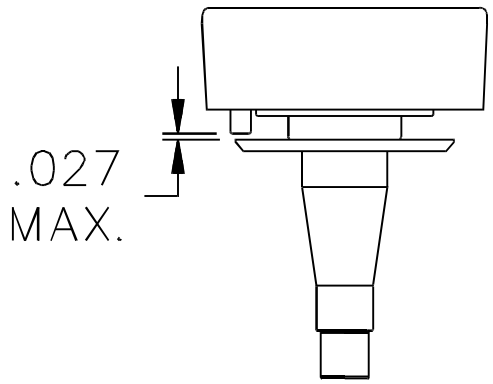


Figure 11 - ABS Sensor and Tone Ring Gap

Section 3
Inspection

Checking the Shock Absorber

Preparation

1. Set the parking brake and block the drive wheels to prevent vehicle movement.

Inspection

1. Check shock absorber for oil leakage, bent components, missing or broken components, excessive corrosion, or worn bushings. Replace shock if any of the above items is present.

Checking the Air Spring and Height Control Valve

Preparation

1. Set the parking brake and block the drive wheels to prevent vehicle movement.
2. Refer to Firestone's Preventative Maintenance Checklist for additional air spring information.

Air Spring Inspection

1. Check the outside diameter of the air spring for irregular wear or heat checking.
2. Check air lines to make sure contact does not exist between the air lines and the outside diameter of the air spring. Re-secure air lines to prevent contact as needed. Check for air line and fitting leaks with soapy water solution.
3. Check to see that there is minimum of 1 inch clearance around the circumference of the air spring while it is energized with air.
4. Check the air spring piston for build up of foreign material. Remove any foreign material that is present.

Height Control Valve Inspection

1. Check the height control valve and linkage for damage. Replace components as needed.
2. Measure the ride height of the suspension. The ride height should be 6-1/16 inches. It is measured at the axle centerline and is the distance from the bottom of the chassis frame rail to the center of the wheel (See Figure 12). An alternate measurement may be taken as the distance between the center of the shock mounts which should be 16-1/8 inches. These measurements can be taken with the vehicle empty or loaded.
3. The actuation arm of the height control valve should be horizontal at ride height (See Figures 13, 14 and 15). See section 5 for adjusting to correct ride height.

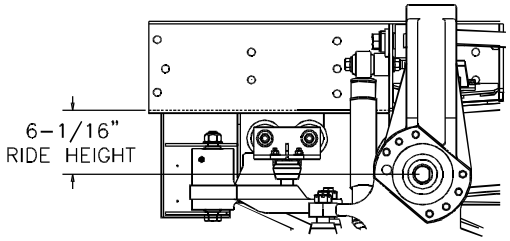


Figure 12 - Ride Height Measurement

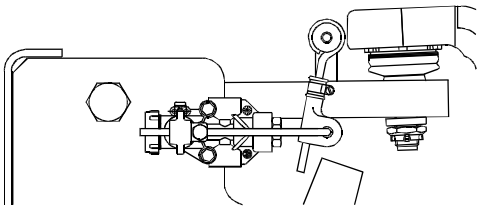


Figure 13 - Height Control Valve (Ridewell)

Section 3
Inspection

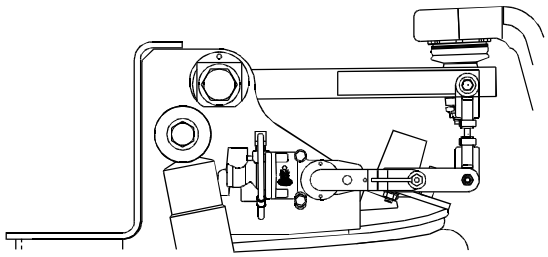


Figure 14 – Height Control Valve (Hadley)

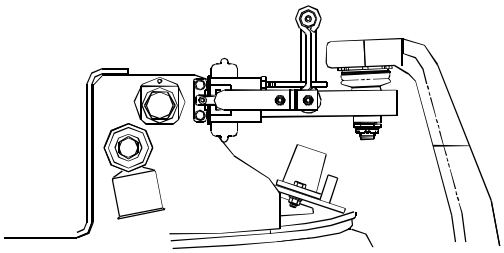


Figure 15 – Height Control Valve (Neway)

Checking the Steering Damper

Preparation

1. Set the parking brake and block the drive wheels to prevent vehicle movement.

Inspection

1. Check steering damper for oil leakage, bent components, missing or broken components, excessive corrosion, or worn bushings. Replace the damper if any of the above items is present.

Checking the Steering Arm Bearings

Preparation

1. Set the parking brake and block the drive wheels to prevent vehicle movement.

Inspection

1. Check that steering arm pivots are free of foreign material and bearing seals are in place. Lubricate as needed.
2. Start vehicle engine. Oscillate the steering wheel and observe the motion of the steering arms (See Figure 16). The steering arms should not exhibit any noticeable conical motion about their pivot axes.
3. If any conical motion is observed check pivot bolt torque which should be **350 lbf•ft**. See Torque Table. Otherwise, replace the bearing set of steering arm which exhibited conical motion.

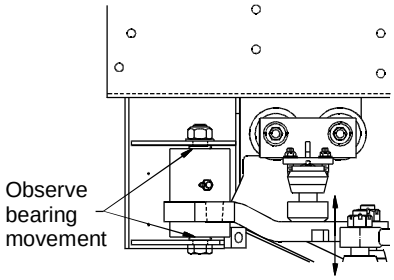


Figure 16 - Steering Arms

Checking the Rebound Bumper Stop

Preparation

1. Set the parking brake and block the drive wheels to prevent vehicle movement.

Inspection

1. Check the rebound bumper stop for deformed shape and chafing. Replace rebound bumper stop as needed.

Section 4
Lubrication and Maintenance

Lubricant Specification and Intervals

COMPONENT	SERVICE INTERVAL	CHANGE INTERVAL	LUBRICANT SPECIFICATION
Ball Studs on Ends of Tie Rods, Relay Rod, Drag Link	Which ever comes first: Every oil change or every 6 months.	N/A	Multi-Purpose Chassis Grease Premium Multi-Purpose Chassis Grease NLGI Grade 2
Bell Crank and Idler Arm	Which ever comes first: 50,000 miles (80,000 kilometers) or once a year.	N/A	Multi-Purpose Chassis Grease NLGI Grade 1 or 2 Lithium Base
Brake S-Cam Tube and Automatic Slack Adjuster [1]	Which ever comes first: Brakes relined. 50,000 miles (80,000 kilometers) or once a year.	N/A	Premium Multi-Purpose Chassis Grease NLGI Grade 2
Wheel End	1000 miles (1600 kilometers) Check fluid level.	Which ever comes first: Seals replaced, brakes relined, 100,000 miles (160,000 km), or once a year.	Gear Oil SAE 80W/90 or equivalent

1. Moly-disulfide type grease is not recommended since it may lower friction capabilities in the adjusting clutch parts of the automatic slack adjuster.

General Lubrication

Proper lubrication practices are important in maximizing the service life of your ReycoGranning® Independent Front Suspension.

CAUTION: Do not mix lubricants of different grades. Do not mix mineral and synthetic lubricants. Different brands of the same grade may be mixed.

CAUTION: Never mix oil bath and grease packed wheel ends.

Ball Joints

The ball joints are lubricated and sealed for their service life and do not require lubrication. Check for oil or grease marks on the exterior of the seal and if found verify that the seal has not been ruptured. If the seal has been ruptured then the ball joint must be replaced because it cannot be re-lubricated.

Ball Studs on Tie Rods, Relay Rod, and Drag Link

1. Review lubricant specification and interval requirements before servicing.
2. Apply lubricant to grease fitting until new lubricant discharges from the dust boot (See Figure 17).

Section 4
Lubrication and Maintenance

Bell Crank and Idler Steering Arms

1. Review lubricant specification and interval requirements before servicing.
2. Apply lubricant to the bell crank and idler steering arms until new lubricant discharges from the bearing seal or from the pressure relief port of the grease fitting. (See Figures 17).

Brake S-Cam Tube and Automatic Slack Adjuster

1. Review lubricant specification and interval requirements before servicing.
2. Apply lubricant to the S-cam tube until new lubricant discharges from the S-camshaft bushing seal next to the automatic slack adjuster. (See Figure 17).
3. Apply lubricant to the automatic slack adjuster until new lubricant discharges from the cone clutch adjacent the adjusting hex nut. (See Figure 17).

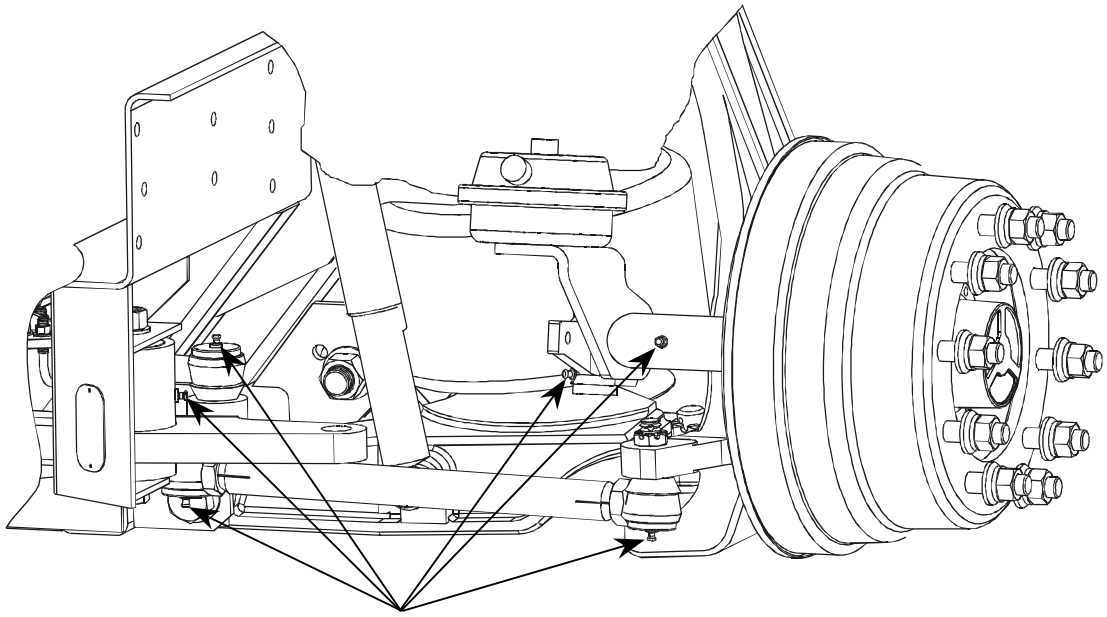


Figure 17 – Location of lubrication fittings. Note: Left side only shown.

Section 4
Lubrication and Maintenance

Wheel Bearings and Hub Cap

1. Review lubricant specification and interval requirements before servicing.
2. Check oil level through hub cap window. If level is below the “add” level line then remove the pipe plug and fill with recommended oil until “full” level is achieved. (See Figure 18). Add oil slowly since the heavy weight oil will settle slowly in the hub. (Note: The hub cap window can only be cleaned with mild soap and water. Aromatic solvents should not be used as they will impair the transparency of the window.)
3. Check the hub cap for external oil marks. The vent plug will normally weep a small amount of oil. Oil marks in other locations should be addressed by replacing the hub cap seal, window gasket, or tightening the pipe fill plug.

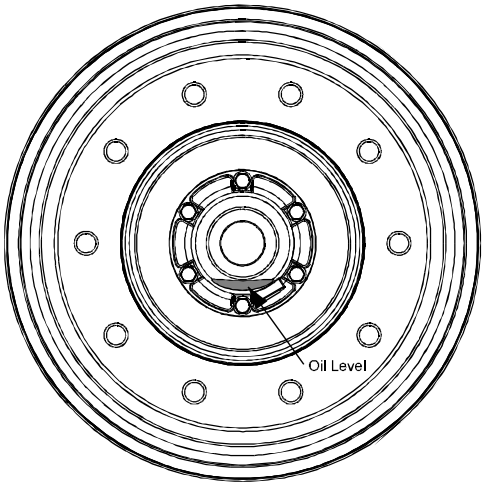


Figure 18 - Wheel Bearing Oil Level

Section 4
Lubrication and Maintenance

MAINTENANCE SCHEDULE

GENERAL MAINTENANCE	SERVICE TO BE PERFORMED	MILEAGE IN THOUSANDS							
		12	24	36	48	60	72	84	96
Ball Joints	Check axial end play.			X			X		
	Inspect for ruptured seals.	X	X	X	X	X	X	X	X[2]
	Check that cotter pin is installed.	X	X	X	X	X	X	X	X[2]
Control Arm Bushings	Check bolt torque.		X		X		X		X[2]
	Inspect for contact between control arm and mount.	X	X	X	X	X	X	X	X[2]
	Inspect for bushing wear.	X	X	X	X	X	X	X	X[2]
Tie Rod Ends	Inspect ball socket end play.	X	X	X	X	X	X	X	X[2]
	Check for looseness of taper connection.	X	X	X	X	X	X	X	X[2]
	Check that cotter pin is installed.	X	X	X	X	X	X	X	X[2]
Brake System	Inspect slack adjuster for correct stroke.	X	X	X	X	X	X	X	X[2]
	Inspect for air leaks using soapy water solution.	X							
Air Springs	Inspect for proper clearance (1" minimum all around).	X							
	Check upper mount nut and lower mount bolt torque.	X							
	Inspect for signs of chafing or wear.	X	X	X	X	X	X	X	X[2]
	Check for air line fitting torque.	X							
	Inspect for air leaks using soapy water solution.	X							
Height Control Valve Linkage	Inspect for signs of bending, binding, or slippage.	X	X	X	X	X	X	X	X[2]
Shock Absorbers	Check stud mount and lock nut torque.	X							
	Inspect shocks for signs of fluid leak, broken eye ends, loose fasteners, or worn bushings.	X	X	X	X	X	X	X	X[2]
Steering Dampers	Check the stud mount and relay rod connection.	X							
	Inspect dampers for signs of fluid leak, broken eye ends, loose fasteners, or worn bushings.	X	X	X	X	X	X	X	X[2]
Steering Arms	Check nut torque.	X							
	Inspect bearings for excessive radial play.	X	X	X	X	X	X	X	X[2]
Rebound Bumpers	Check for deformed shape and chafing.	X	X	X	X	X	X	X	X[2]
Wheels	Check bearing end play.				X				X[2]
	Check wheel nut torque[1].	X	X	X	X	X	X	X	X[2]
Front Alignment	Inspect toe-in[3].		X		X		X		X[2]
Air Fittings and Air Lines	Inspect for air leaks using soapy water solution.	X							
	Inspect for signs of chafing, cracking, or wear.	X	X	X	X	X	X	X	X[2]

1. Wheel nuts must be re-tightened to proper torque specifications as per the vehicle or chassis manufacturer's Owner Guide.

2. Continue to perform specified maintenance every 12,000 miles or at previous interval.

3. Toe-in should be inspected after vehicle completion by final stage manufacturer.

Section 4
Lubrication and Maintenance

MAINTENANCE RECORD

Name of Owner			Address of Owner
Date of Purchase	Name and Address of Dealer		
Model of Vehicle	Vehicle Identification Number		
Suspension Model Number: **IFS1200** **IFS1320-HP** **IFS1320-SP**	Suspension Serial Number:		
Inspection and Maintenance Item	Date	Mileage	Service Performed

Section 5
Adjustments and Alignments

Adjusting Suspension Ride Height

The height control valve and linkage should be checked regularly for proper clearance, operation and adjustment.

NOTE: Improperly adjusted ride height will result in incorrect alignment measurements and may result in abnormal tire wear. Check ride height prior to front suspension alignment.

The ride height of the front suspension is the distance from the bottom of the chassis frame rail to the center of the wheel spindle. Properly adjusted ride height results in correct suspension travel and alignment. The ride height should not be adjusted to adjust chassis rake angle.

Preparation

1. Park the vehicle on a level surface.
2. Set the parking brake and block the drive wheels to prevent vehicle movement.
3. Check that the rear suspension is adjusted to the correct ride height per the vehicle manufacturers specifications.
4. Check height control valve plumbing to ensure there are not any air leaks.
5. Make sure shock mounts are mounted securely and not bent.

NOTE: Before performing any adjustment or maintenance, identify the style of the height control valve. See Section 3, Height Control Valve Inspection.

Adjustment (Ridewell Valve)

1. Measure the distance between the centers of the shock mounts. If the distance is not within 16-1/8 ± 1/8 inches then adjust as follows.
2. Disconnect height control valve linkage on the opposite side and allow the air spring to deflate by rotating the height control valve arm down. Do not alter length when disconnecting.
3. Loosen clamp on vertical link of the height control linkage to be adjusted.
4. Adjust the length of the vertical link to achieve specified ride height. If the measured distance is less than 16-1/8 inches then decrease the length of the vertical link. If the measured distance is more than 16-1/8 inches then increase the length of the vertical link. Wait 30 seconds for suspension to “settle” after adjusting to verify correct adjustment.

NOTE: The horizontal link must remain horizontal during adjustment to ensure proper operation of the height control valve.

5. Tighten the clamp on vertical link.
6. Reconnect the height control valve linkage on the other side and repeat steps 2-4 for the opposite side as needed.
7. Verify that the ride height is correct on both sides.

NOTE: The height control valves must be adjusted individually.

Section 5
Adjustments and Alignments

Height Control Valve Adjustment

1. Measure the distance between the centers of the shock mounts. If the distance is not within 16-1/8 ± 1/8 inches then adjust as follows.
2. Disconnect height control valve linkage on the opposite side and allow the air spring to deflate by rotating the height control valve arm down. Do not alter length when disconnecting.
3. Loosen adjusting bolt (see Figures 19 and 20) on actuation arm.
4. Rotate the actuation arm to achieve specified ride height. Wait 30 seconds for suspension to "settle" after adjusting to verify correct adjustment.
5. Tighten the adjusting bolt on the actuation arm.
6. Reconnect the height control valve linkage on the other side and repeat steps 2-4 for the opposite side as needed.
7. Verify that the ride height is correct on both sides.

NOTE: Sway bar equipped suspensions have only one height control valve installed to the center of the sway bar. Adjustment is similar to above.

NOTE: The height control valves must be adjusted individually.

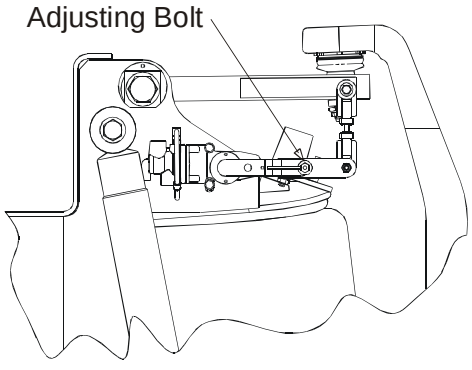


Figure 19 – Hadley Height Control Valve Adjustment.

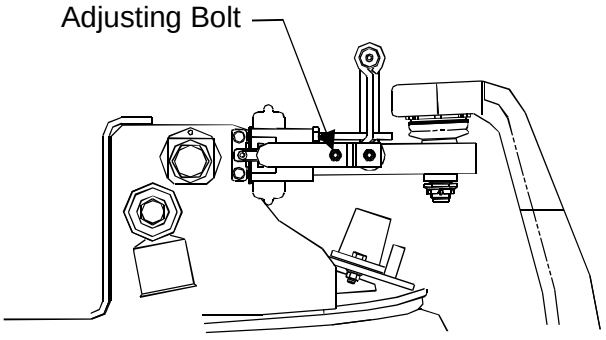


Figure 20 – Neway Height Control Valve Adjustment.

Section 5
Adjustments and Alignments

Checking and Adjusting the Wheel Bearings

Preparation

1. Set the parking brake and block the drive wheels to prevent vehicle movement.
2. Raise the vehicle until the front wheels are off the ground. Support raised vehicle with safety stands. Do not place jacks or safety stands under the lower control arms to support the vehicle.

WARNING: Never work under a vehicle supported by only a jack. Jacks can slip or fall over and cause serious personal injury. Always use safety stands.

3. If the tire and wheel are not removed make sure all the wheel nuts are tightened to the specified torque of **450-500 lbf•ft**. See Torque Table.
4. If the tire and wheel are removed (recommended for aluminum wheels) secure the brake drum to the hub with the wheel nuts or remove the brake drum.
5. Remove the vent plug from the hub cap.

Adjustment

1. Attach a dial indicator with a magnetic base to the face of the wheel, hub, or brake drum. The dial indicator may also be attached to the bottom of the brake drum if the wheel is removed.
2. Place the tip of the dial indicator on the center of the steering knuckle spindle. Set the dial indicator on zero. (See Figure 21).

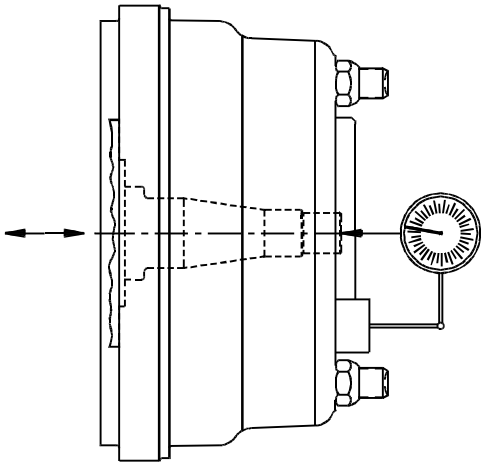


Figure 21 - Wheel End Play Measurement

NOTE: Do not push/pull at the top and the bottom of the tire, drum, or hub. Pushing or pulling at the top and the bottom will not yield a true measurement of the end play.

3. Measure the end play by simultaneously pushing/pulling on each side of the tire, drum, or hub while observing the dial indicator. The end play is the total travel observed. If the end play is not within .001-.004 inch adjust the wheel bearings per steps 4-16. (See Figure 21). Otherwise skip to step 17.
4. Place an oil drip tub beneath the hub to catch oil. Rotate the hub such that the hubcap drain plug is facing upwards. Remove the drain plug from the hubcap and place it in a container for re-installation.
5. Rotate the hub such that the drain hole faces downward and drain the oil from hub cavity. Wait a few

minutes for most of the oil to drain before continuing to the next step.

6. Remove the hub cap bolts, hub cap, and gasket. Take care not to damage the gasket for reinstallation. Place the components in a location to prevent contamination. Note that the hub cap window may be damaged by solvents.

NOTE: When removing or installing the inner and outer spindle nuts, use the correct wrench sockets to avoid damaging the nuts. Do not use impact driver to tighten inner and outer nuts. Only use a torque wrench to tighten the nuts.

7. Unbend the retainer washer and remove the spindle outer nut, retainer washer, and locking washer. Loosen the inner spindle nut.
8. Seat the bearings by tightening the inner spindle nut to **180 lbf•ft**. while rotating the wheel in both directions.
9. Rotate the hub and drum ten (10) complete revolutions.
10. Loosen the inner spindle nut completely and then tighten the nut to **20 lbf•ft**.
11. Back off the inner spindle nut 1/4 turn.
12. Install spindle locking washer.

NOTE: If the dowel pin of the inner spindle nut and a hole in the locking washer are not aligned, turn the locking washer over and re-install. If required, loosen the inner spindle nut just enough for alignment.

CAUTION: Never tighten the inner spindle nut to align the dowel pin with hole in locking washer. This can pre-load the bearings and cause premature bearing failure.

13. Install the retainer washer and outer spindle nut. Tighten outer spindle nut to **200-300 lbf•ft**. See Torque Table.
14. Verify that wheel end play is between .001-.004 inch. (See step 3). If not, repeat by altering amount of inner nut back off until end play is achieved.
15. Bend retainer washer over one wrench flat of the outer nut.
16. Install hub cap gasket and hub cap. Tighten the cap screws to 20-30 lbf•ft. See Torque Table. Replace the hub cap vent plug if removed in Preparation step 5.
17. Fill the hub cavity with the appropriate amount and type of lubricant. (See Section 4 for lubricant specifications).
18. Install vent plug.

Adjusting the Maximum Turn Angle

CAUTION: See Table 5-1 for the proper turn angle. Do not exceed this set angle. Misadjustment of the turn angle can cause damage to steering system components.

Check the turn angle if the front tires rub against the frame, suspension, body, or if

the steering gear has been serviced. Use an alignment machine to check the angle. See the procedure of the alignment machine manufacturer.

The steering stop bolt on the suspension subframe controls the maximum turn angle. If the stop bolt is missing, bent, or broken; replace the stop bolt(s) or jam nut(s) and follow the procedure below for adjustment. Inspect other suspension components for damage.

In the course of adjusting the steering stop(s), the steering gear poppet valves may require readjustment. Refer to TRW's TAS Steering Gear Service Manual for readjusting the poppets.

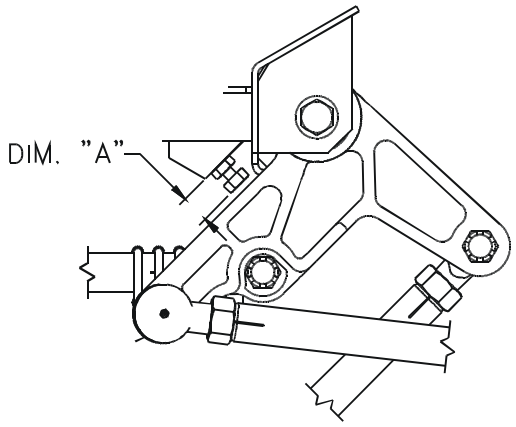


Figure 22 - Steering Arm Stop Bolt

Steering Arm Stop Settings		
Model	**Max. Steer Angle**	**Min. Dim. "A"**
IFS1370-HP	45°	1.12"
IFS1200-HP	45°	1.12"
IFS1200S2	50°	0.875"

Table 5-1

⚠ CAUTION: In power steering systems, the hydraulic pressure should relieve or "drop off" when the steered wheels approach the steering stops in either direction. If the pressure does not relieve, the components of the front suspension may be damaged.

Preparation

1. Set the parking brake and block the drive wheels to prevent vehicle movement.
2. Place the front tires on a suitable device that allows the front wheels to turn and measures the wheel turn angle.
3. Check that the steering gear is centered and the tires are steered straight ahead with equal toe-in side to side. If either of these two conditions is not met, then adjust toe-in first before centering the steering gear. See Adjusting the Toe-In Section and refer to Spartan chassis service guidelines for centering the steering gear.

NOTE: Unequal toe-in side to side or an out-of-center steering gear can result in unequal turn angles and steering pull while steering straight ahead. The drag link length may be adjusted to attain steering gear on center condition while maintaining equal toe-in side to side.

4. Check that the lengths of the outer tie rods are equal to each other within 1/8 inch. If not, adjust lengths according to the Adjusting the Toe-In Section before adjusting the steering stops.

NOTE: Do not adjust the length of the drag link or tie rods to center the steering wheel. This can cause the steering gear to become off center.

Section 5
Adjustments and Alignments

Adjustment

1. Turn the steering wheel until the steering arm contacts the stop bolt or the steering wheel stops turning (See Figure 22). Measure the turn angle of the wheel on the same side as the turn (i.e. inside wheel).
2. If the wheel turn angle differs from Table 5-1 then adjust as follows.
3. Loosen the jam nut on the stop bolt.
4. Turn the stop bolt until the specified wheel turn angle is achieved and the bolt head contacts the steering arm.
5. Tighten the jam nut to **90-110 lbf•ft**. See Torque Table.

> ⚠ **CAUTION: After readjusting the steering stop(s) check that the steering poppets are reset properly and that the front tires do not contact the frame, suspension, or body. Also check for 1/2" minimum clearance between the air spring and brake dust cover.**

6. Repeat checking and adjustment for turning the opposite direction.

Inspection Before Alignment

Check the following before conducting front wheel alignment measurements.

Inspection

See "General Inspection" in Section 3.

Wheels and Tires

1. Check that the front tires are inflated to the appropriate pressure based on the wheel loading.
2. Check that the front tires are the same size and type.
3. Check that all the wheel nuts are tightened to the specified torque of **450-500 lbf•ft**. See Torque Table.
4. Check that the wheels are balanced.

Front Suspension

1. Check that all fasteners are tightened to the specified torque.
2. Check the suspension ride height and adjust as needed to the specified height.
3. Check for worn ball joints, tie rod ends, steering arm bearings, control arm bushings, and damaged suspension components. Replace worn components as needed.
4. Check for loose ball joint and tie rod end tapered connections, tie rod end jam nuts, steering arm mounts, and chassis steering system components. Inspect connections for wear and replace as needed. Tighten connections as needed.
5. Check the wheel bearing adjustment and adjust as needed.
6. Inspect the shock absorbers for wear and damage.

Rear Axle and Suspension

Section 5
Adjustments and Alignments

Front tire wear and incorrect steering can be caused by the rear axle and/or suspension.

1. Check that all fasteners are tightened to the specified torque.
2. Check the suspension ride height and adjust as needed to specified height.
3. Check that all connection joints between the suspension and axle are secure.
4. Check for worn suspension bushings or damaged suspension components.
5. Check that the rear axle is correctly aligned.
6. Check that the frame is not bent.
7. Refer to any additional recommendations and specifications from the manufacturer of the chassis on rear axles and suspensions.

NOTE: Total vehicle alignment is recommended when aligning the front suspension.

Front Wheel Alignment

Equipment

Granning recommends that suitable alignment equipment be used to measure the wheel alignment characteristics: camber, caster, and toe-in. The alignment equipment must be properly calibrated for accurate measurements. Only qualified personnel should conduct the wheel alignment measurements.

General

The overall toe-in of the front wheels should be checked every 24,000 miles or 2 years. When the vehicle does not steer correctly or the front tires develop an abnormal tire wear pattern, the camber, caster, and toe-in should be measured and adjusted as needed. Toe-in typically has the largest effect on tire wear.

The maximum wheel turn angle should be checked and adjusted as needed.

Eccentric adapters may or may not be installed in left or right hand upper control arm mounts. The purpose of the adapters is to provide additional adjustment of camber and caster to minimize vehicle drifts or pulls to one side of the road. The eccentric adapters must be installed in the upper control arm mounts to adjust the camber and/or caster of the respective wheel.

Preparation

1. Follow the manufacturer's procedures for preparing the vehicle for front and rear wheel alignment measurements.
2. Set the parking brake to prevent vehicle movement.

NOTE: An out-of-center steering gear can result in unequal turn angles . The steering gear should remain centered during toe-in adjustment.

NOTE: Do not adjust the length of the drag link or tie rods to center the steering wheel. This can cause the steering gear to become off center.

3. Check that the steering gear is centered when the tires are steered straight ahead(i.e. equal toe-in

side to side). Center the steering gear according to Spartan's guidelines.

4. Measure and record the individual wheel camber, caster, and toe-in of the front suspension. Also measure and record the cross camber, cross caster, and overall toe-in.
5. If adjustment to camber and caster is required then follow the steps below. Otherwise, go to the "Adjusting the Toe-In" section to adjust the toe-in as needed.
6. Raise the vehicle until the front wheels are off the ground. Support the raised vehicle with safety stands. Do not place jacks or safety stands under the lower control arms to support the vehicle.

WARNING: Never work under a vehicle supported by only a jack. Jacks can slip or fall over and cause serious personal injury. Always use safety stands.

Adjusting the Camber Angle

CAUTION: ReycoGranning® does not recommend adjusting the ride height or altering components to adjust the suspension camber. Alteration of components may cause a vehicle accident and serious personal injury.

Camber is the angle of the tire with respect to the ground. Camber is positive when the distance between the top of the wheels is greater than the distance at the ground. A small amount of positive camber is built into the suspension because camber changes with load and chassis roll.

The camber of the suspension is affected by the ride height of the suspension. If the ride height is set too high then the camber measurement will be more positive. See the "Checking and Adjusting Suspension Ride Height" sections before measuring camber. The table below lists the recommended camber angles.

Nominal Camber Values-Degrees		
	Unloaded	Loaded
Left	+1/4°(±1/4°)	+1/4°(±1/4°)
Right	+1/4°(±1/4°)	+1/4°(±1/4°)

The set screw in the eccentric adapter denotes the orientation of the eccentricity of the adapter. When the set screw is in the 6 o'clock or 12 o'clock position, then the adapter is in the "neutral" position. There are two adapters at each control arm mount and they must be oriented the same.

When the set screws in both control arm mounts are oriented closer to the frame rail, the wheel camber becomes more positive. When the set screws in both control arm mounts are oriented farther from the frame rail, the wheel camber becomes more negative. The eccentric adapters at both upper control arm mounts must be oriented the same to affect only camber.

1. Turn the wheel to provide access to the upper control arm mount.
2. Loosen both upper control arm mounting bolts at the eccentric adapters. Do not remove the bolts because the adapters must remain

engaged in control arm mounting plate for adjustment.

3. Loosen the set screws.
4. Rotate each eccentric adapter to the same orientation as needed based on measured wheel camber. The eccentric adapters at each control arm mount must have the same orientation.
5. Tighten the adapter locknuts to **460-490 lbf•ft**. See Torque Table.
6. Tighten the set screws to **30-40 lbf•in**. See Torque Table.
7. Remove the jack stands and lower vehicle completely. Check that the suspension is at the proper ride height.
8. Re-measure the camber and readjust as needed.

Adjusting the Caster Angle

CAUTION: ReycoGranning® does not recommend adjusting the ride height or altering components to adjust the suspension caster. Alteration of components may cause a vehicle accident and serious personal injury.

The caster angle is the angle from the vertical position to the axis defined by the ball joints when seen from the side of the vehicle. When the top of ball joint axis is toward the rear of the vehicle, then the caster is positive. Positive caster creates a self-aligning moment to stabilize the vehicle when driving straight ahead.

The caster is indirectly measured from the change in wheel camber as the wheel is turned through a prescribed arc. Therefore, the calculated caster of the wheel is affected by the ride height of the suspension. See the "Checking and Adjusting Suspension Ride Height" sections before measuring caster. The table below lists the recommended caster angles.

Nominal Caster Values-Degrees		
	Unloaded	Loaded
Left	+3°(±1/2°)	+3°(±1/2°)
Right	+3-1/2°(±1/2°)	+3-1/2°(±1/2°)

The set screw in the eccentric adapter denotes the orientation of the eccentricity of the adapter. When the set screw is in the 6 o'clock or 12 o'clock position, then the adapter is in the "neutral" position. There are two adapters at each control arm mount and they must be oriented the same.

When the set screws in the forward control arm mount are oriented closer to the frame rail and the set screws in the rearward control arm mount are oriented farther from the frame rail, the wheel caster becomes more positive. When the set screws in the forward control arm mount are oriented farther from the frame rail and the set screws in the rearward control arm mount are oriented closer to the frame rail, the wheel caster becomes more negative. The eccentric adapters at both upper control arm mounts must be oriented opposite each other to affect caster.

1. Turn the wheel to provide access to the upper control arm mount.
2. Loosen both upper control arm mounting bolts at the eccentric adapters. Do not remove the bolts because the adapters must remain

engaged in control arm mounting plate for adjustment.

3. Loosen the set screws.
4. Rotate the eccentric adapters at the forward and rearward control arm mounts opposite one another as needed based on measured wheel caster. The eccentric adapters at each control arm mount must have the same orientation.
5. Tighten the adapter locknuts to **460-490 lbf•ft**. See Torque Table.
6. Tighten the set screws to **30-40 lbf•in**. See Torque Table.
7. Remove the jack stands and lower vehicle completely. Check that the suspension is at the proper ride height.
8. Re-measure caster and readjust as needed.

Adjusting the Toe-In

WARNING: Most tire wear is caused by incorrect toe-in settings. ReycoGranning® does not recommend altering components to adjust the suspension toe-in except the tie rod lengths. Alteration of components may cause a vehicle accident and serious personal injury.

Toe is the relationship of the distance between the front and rear of the front tires. When the front distance is less than the rear distance, the wheels are "toed-in". Toe-in is designed into the suspension to counteract the tendency of the tires to toe-out when the vehicle is driven straight ahead. Incorrect toe-in can result in rapid tire wear.

1. Measure the length of the outer tie rods. If the lengths of the outer tie rods are not within 1/8 inch of each other, follow steps 2-8, otherwise skip to step 10.
2. Disconnect the drag link at the bell crank steering arm.
3. Loosen the jam nuts on both ends of the right and/or left outer tie rod which requires length adjustment. The outer tie rod reference length is 20-3/4 inches. **Note**: The jam nut with the left hand threads has a groove in each hex point around the circumference.
4. Adjust the length of the outer tie rods such that they are within 1/8 inch of each other. Tighten the jam nuts to **110-130 lbf•ft.** See Torque Table.
5. Loosen the relay rod jam nuts and the U-bolts that secure the steering damper mount bracket to the relay rod. Note: The jam nut with the left hand threads has a groove in each hex point around the circumference.
6. Adjust the length of relay rod such that the toe-in on each side is 1/16" ± 1/32" and the over all toe-in is 1/8" ± 1/16". Tighten jam nuts to **110-130 lbf•ft.** See Torque Table.
7. Re-secure the steering damper mount bracket to the relay rod. The bracket should be mounted such that the distance between damper mounts is 19 inches when the suspension is steered straight. See Repair Section 6 for damper installation. Tighten U-bolt lock nuts to **25-30 lbf•ft.** See Torque Table.

8. Adjust the length of the drag link accordingly such the steering gear remains centered and the wheels are steered straight ahead with equal toe-in side to side. Reconnect it to the bell crank steering arm. Tighten the ball stud castle nut to **130-150 lbf•ft.** Tighten the jam nuts to **110-130 lbf•ft.** See Torque Table.
9. Re-measure the right, left, and overall toe of the suspension. The right and left toe-in should be 1/16" ± 1/32" and overall toe-in should be 1/8" ± 1/16". *Skip to end of procedure.*
10. Loosen the relay rod jam nuts and the U-bolts that secure the steering damper mount bracket to the relay rod. Note: The jam nut with the left hand threads has a groove in each hex point around the circumference.
11. Adjust the length of relay rod such that the toe-in on each side is 1/16" ± 1/32" and the over all toe-in is 1/8" ± 1/16". Tighten jam nuts to **110-130 lbf•ft.** See Torque Table.
12. Re-secure the steering damper mount bracket to the relay rod. The bracket should be mounted such that the distance between damper mounts is 19 inches when the suspension is steered straight. See Repair Section 6 for damper installation. Tighten U-bolt lock nuts to **25-30 lbf•ft.** See Torque Table.
13. Re-measure the right, left, and overall toe of the suspension. The right and left toe-in should be 1/16" ± 1/32" and overall toe-in should be 1/8" ± 1/16".

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Section 6
Repair

Repairing of Parts

The repair or reconditioning of front suspension components is not allowed. ReycoGranning® recommends replacing damaged or worn components. Several major components are heat treated and tempered.

The components cannot be bent, welded, heated or repaired in any way without reducing the strength or life of the component and voiding the warranty.

The following operations are prohibited on front suspension components.

1. Welding of or to the steering knuckles, lower control arms, steering arms, tie rod assemblies, the brakes, the hubs, and the brake drums.
2. Hot or cold bending of the steering knuckles, the upper and lower control arms, the steering arms, the tie rod assemblies, the ball joints, and the subframe except control arm and steering arm mounts which may be cold bent to facilitate bushing and bearing replacement.
3. Drilling out control arm and steering arm mounting holes and ball stud tapered holes.
4. Spray welding of bearing diameters on the steering knuckle spindle, steering arm bores and pivot tube. Spray welding of ball studs or tapered holes for the ball joint and tie rod ends.
5. Milling or machining of any component except that control arm bushing bores may be honed to remove any burrs.

⚠ WARNING: If you use cleaning solvents, hot solution tanks or alkaline solutions incorrectly, serious personal injury can occur. To prevent injury, follow the instructions supplied by the manufacturer. Do NOT use gasoline to clean parts. Gasoline can explode.

Cleaning the Parts

Ground or Polished Parts

Use a cleaning solvent to clean ground or polished parts and surfaces. Do NOT clean ground or polished parts with hot solution tank or with water, steam or alkaline solutions. These solutions will cause corrosion of the parts.

Rough Parts

Rough parts can be cleaned with the ground and polished parts. Rough parts also can be cleaned in hot solution tanks with a weak alkaline solution. Parts should remain in the hot solution tanks until they are completely cleaned.

Drying

Parts must be dried immediately after cleaning. Dry parts with clean paper or rags, or compressed air. Do not dry bearings by spinning with compressed air.

Preventing Corrosion

Apply a light oil to cleaned and dried parts that are not damaged and are to be immediately assembled. Do NOT apply oil to the brake linings or the brake drums. If the parts are to be stored, apply a good corrosion preventative to all surfaces and place them inside special paper or containers that prevent corrosion. Do

NOT apply corrosion preventative to the brake linings or the brake drums.

Replacing the Drag Link

Preparation

1. Set the parking brake and block the drive wheels to prevent vehicle movement.

Removal

1. Remove the cotter pins from the ball studs. (See Figure 23)
2. Remove the castle nuts from the ball studs.
3. Disconnect the drag link from the bell crank steering arm and the pitman arm. The ball stud may be forced from the tapered hole by use of a suitable tool.

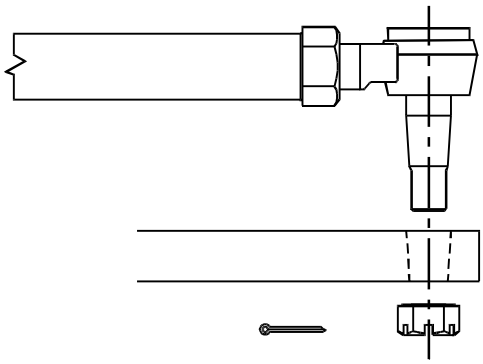


Figure 23 - Drag Link Ball Stud

CAUTION: Do not strike the steering arm or the pitman arm directly with a steel hammer. Parts can break and cause serious personal injury. Wear eye protection.

4. Inspect the drag link and mating tapers. See Section 3. If grease boot is damaged during removal, replace it before installation.

Installation

1. Connect the drag link to the bell crank steering arm. (See Figure 22). Note that the ball stud is smaller at this connection.
2. Connect the drag link to pitman arm.

CAUTION: Tighten the castle nuts to the specified torque. If the castle nuts are not tightened to the specified torque, the parts will be damaged and serious personal injury may occur.

3. Tighten the castle nut at the steering and pitman arm connection to **130-150 lbf•ft**. See Torque Table.
4. Install the cotter pins. If necessary, tighten the castle nut to align the hole in the ball stud and slots in the castle nut. Do not loosen the castle nut to install the cotter pin.
5. Lubricate the drag link. See Section 4, Lubrication and Maintenance.
6. Check for correct operation. See Section 5 Alignment and Adjustment.

Replacing the Relay Rod and Outer Tie Rods

Preparation

1. Set the parking brake and block the drive wheels to prevent vehicle movement.

Section 6
Repair

Removal

1. Remove the cotter pins from the ball studs. (See Figure 24).
2. Remove the castle nuts from the ball studs.
3. Disconnect the steering damper mount from the relay rod.
4. Disconnect the relay rod from the bell crank and idler steering arms. The ball stud may be forced from the tapered hole by use of a suitable tool.
5. Disconnect the outer tie rod from the bell crank or idler steering arm and the steering knuckle. The ball stud may be forced from the tapered hole by use of a suitable tool.

CAUTION: Do not strike the steering arms or the steering knuckles directly with a steel hammer. Parts can break and cause serious personal injury. Wear eye protection.

6. Inspect the relay rod and/or the outer tie rod and mating tapers. See Section 3. If grease boot is damaged during removal, replace it before installation.

Installation

1. Connect the relay rod to the bell crank and idler steering arms. (See Figure 24).
2. Connect the steering damper mount to the relay rod such that the distance between damper mounts is 18 inches when the suspension is steered straight. See Torque Table. (See Figure 25).
3. Connect the outer tie rod from the bell crank or idler steering arm and the steering knuckle. (See Figure 24).

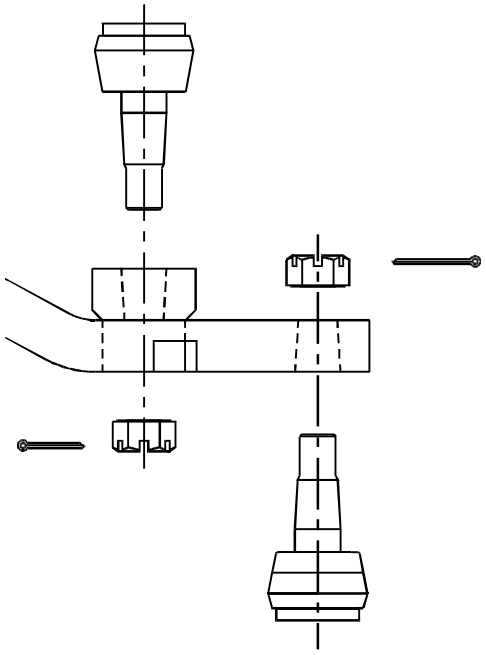


Figure 24 - Tie Rod Steering Arm Connection

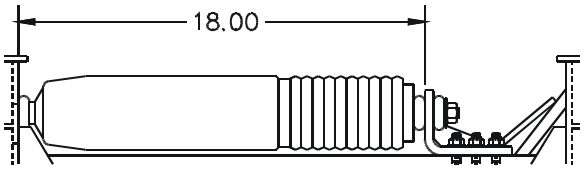


Figure 25 - Steering Damper Mount Location

CAUTION: Tighten the castle nuts to the specified torque. If the castle nuts are not tightened to the specified torque, the parts will be damaged and serious personal injury may occur.

4. Tighten the castle nuts to **130-150 lbf•ft**. See Torque Table.
5. Install the cotter pins. If necessary, tighten the castle nut to

align the hole in the ball stud and slots in the castle nut. Do not loosen the castle nut to install the cotter pin.

6. Lubricate the relay rod and/or outer tie rod. See Section 4, Lubrication and Maintenance.
7. Check for correct operation. See Section 5 Alignment and Adjustment.

Replacing the Ball Joints

Ball joints may be replaced individually, however, it is recommended to replace upper and lower ball joints at the same time. The ball joints cannot be rebuilt or repaired.

Press-In Mount

The pressed in mount type of upper ball joint is installed by pressing the base of the ball joint into the steering knuckle and securing the base with retainer clips. The steering knuckle should be properly supported during removal of the upper ball joint. The upper ball joint should be properly supported during installation of the ball joint.

Thread-In Mount

The thread-in mount type upper and lower ball joints are installed with a thread adhesive and may require the threads to be warmed to ease removal. If heat is applied to the ball joint threads, the steering knuckle temperature must not exceed 300° F and the heat should be applied at the bottom of the ball joint base only. Applying heat to the ball joint will damage the ball joint by destroying the ball stud seal permanently, degrading the lubricant, and restricting ball stud movement.

It is recommended that the appropriate tools be used to remove the ball stud taper from the control arms and to remove the ball joints from the steering knuckle. A suspension alignment should be performed after ball joint replacement.

NOTE: Be careful to not displace or damage ball joint seals during removal from the control arm taper hole.

Preparation

1. Set the parking brake and block the drive wheels to prevent vehicle movement.
2. Raise the vehicle until the front wheels are off the ground. Support raised vehicle with safety stands. Do not place jacks or safety stands under the lower control arms to support the vehicle.

WARNING: Never work under a vehicle supported by only a jack. Jacks can slip or fall over and cause serious personal injury. Always use safety stands.

3. Remove the tires and check that the air springs are deflated.

Upper Ball Joint Removal - Press-In Mount

1. Remove the cotter pin from the ball stud.
2. Remove the castle nut from the ball stud.

WARNING: The steering knuckle is heavy and unevenly balanced. Use a portable crane or suitable jack to support it prior to disconnecting it from the control arm.

3. Disconnect the upper control arm. The ball stud may be forced from the tapered hole by use of a suitable tool.

CAUTION: Do not strike the upper control arm directly with a steel hammer. Parts can break and cause serious personal injury. Wear eye protection.

4. Inspect the ball joint taper and upper control arm tapered hole. If abnormal wear exists on the ball stud taper or in the tapered hole, replace the upper control arm.
5. Loosen socket head cap screws and remove the retainer clips. (See Figure 26).
6. Place support under steering knuckle upper ball joint mount. Press upper ball joint out of steering knuckle by applying load to the bottom of its base. (See Figure 27).

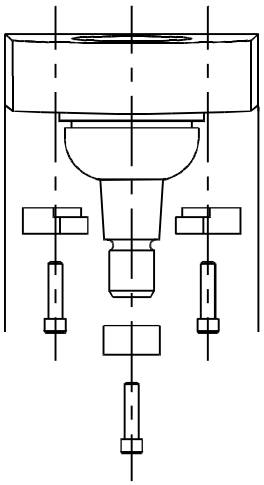


Figure 26 - Press-In Mount Upper Ball Joint Retainer Clips

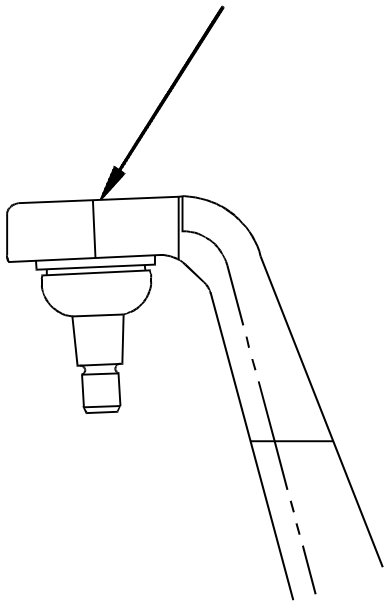


Figure 27 - Press-In Mount Upper Ball Joint Removal

Upper Ball Joint Removal - Thread-In Mount

1. Follow steps 1-4 for press-in mount type.
2. Secure steering knuckle in a vise or similar device. Loosen the ball joint and remove it from the steering knuckle.

Upper Ball Joint Installation - Press-In Mount

1. Inspect ball joint bore in the steering knuckle and remove any burrs by honing.
2. Place the new ball joint into a support tube such that it is supported only by the step diameter.
3. Align the upper ball joint bore of the steering knuckle with the ball joint. Press the steering knuckle onto the ball joint until the step diameter is seated against the steering knuckle.
4. Install the retainer clips and socket head cap screws.
5. Tighten the socket head cap screws to **15-20 lbf•ft**. See Torque Table.
6. Connect the ball joint to the upper control arm.
7. Tighten the castle nut to **155-170 lbf•ft**. See Torque Table.
8. Install the cotter pin. If necessary, tighten the castle nut to align the hole in the ball stud and slots in the castle nut. Do not loosen the castle nut to install the cotter pin.

Upper Ball Joint Installation - Thread-In Mount

1. Inspect the threads in the steering knuckle and remove any burrs or debris.
2. Apply thread adhesive Loctite #242 or equivalent to the ball joint threads and thread the ball joint into the steering knuckle.
3. Tighten the base of the ball joint to **325-375 lbf•ft**. See Torque Table.
4. Follow steps 6-8 for press-in mount type.

Lower Ball Joint Removal

1. Remove the cotter pin from the ball stud.
2. Remove the castle nut from the ball stud.

WARNING: The steering knuckle is heavy and unevenly balanced. Use a portable crane or suitable jack to support it prior to disconnecting it from the control arm.

3. Disconnect the lower control arm. The ball stud may be forced from the tapered hole by use of a suitable tool.

CAUTION: Do not strike the lower control arm directly with a steel hammer. Parts can break and cause serious personal injury. Wear eye protection.

4. Inspect the ball joint taper and upper control arm tapered hole. If abnormal wear exists on the ball stud taper or in the tapered hole, replace the lower control arm.
5. Secure steering knuckle in a vise or similar device. Loosen the ball joint and remove it from the steering knuckle.

Lower Ball Joint Installation

1. Inspect the threads in the steering knuckle and remove any burrs or debris.
2. Apply thread adhesive Loctite #242 or equivalent to the ball joint threads and thread the ball joint into the steering knuckle.
3. Tighten the base of the ball joint to **525-575 lbf•ft**. See Torque Table.
4. Connect the ball joint to the lower control arm.
5. Tighten the castle nut to **330-370 lbf•ft**. See Torque Table.
6. Install the cotter pin. If necessary, tighten the castle nut to align the hole in the ball stud and slots in the castle nut. Do not loosen the castle nut to install the cotter pin.

Replacing the Bell Crank and Idler Steering Arm Bearings

Replace the bell crank and idler steering arm bearings in sets. The replacement bearings should be installed by pressing on the outer raceway only. Pressing on the inner raceway will damage the bearing.

The inner grease cavity of the steering arms should be cleaned when the bearings are replaced.

Preparation

1. Follow the procedures for removal of the ball studs of the drag link, relay rod, and outer tie rods from the steering arms before replacing the bell crank and idler steering arm bearings.

Removal

1. Remove the pivot bolt that mounts the steering arm and remove the steering arm from the subframe.
2. Remove the snap rings from the pivot sleeve and remove the sleeve. A rubber or brass hammer may be used to remove the sleeve. Retain shims.
3. Support the steering arm bearing housing and press the bearing out of each end of the steering arm.

Installation

1. Clean out the steering arm grease cavity.
2. Inspect steering arm bearing housing bores and remove burrs by honing. Replace steering arm if the bore is damaged.
3. Support the steering arm bearing housing and press the replacement bearing into each end of the steering arm. Note that the seal side of the bearing should face out. Replacement bearings with seals on each side should have one seal removed to allow grease access.
4. Inspect the pivot sleeve and remove burrs with emery cloth.
5. Use a rubber mallet or similar tool to drive the inner sleeve up such that the bottom retaining ring is seated against the bottom inner race. Do not use a steel hammer to install the sleeve because bearing raceways can be damaged.
6. Install upper retaining ring.
7. Determine the number of shims (p/n 8611) needed by stacking the shims and placing the stack between the upper retaining ring

and inner race until a snug fit is achieved. Remove one shim from the stack and this is the number of shims needed. A maximum of six shims may be used.

8. Remove the upper retaining ring, install the shims determined in step 7 onto the inner sleeve at upper inner race, and re-install the upper retaining ring. Check that upper retaining ring is properly seated in the groove of the inner sleeve. (See Figure 28).
9. Place the steering arm in its mount and install the pivot bolt. Tighten the pivot bolt lock nut to **350 lbf•ft**. See Torque Table.
10. Follow the procedures for installation of the drag link, relay rod, and outer tie rods.

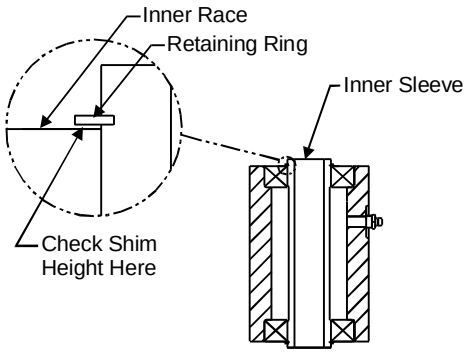


Figure 28 – Location of Shims

Replacing the Upper and Lower Control Arm Bushings

The subframe control arm mounts may require widening to accommodate replacement bushings. The width may be increased by inserting a suitable jack between the bushing mounts and cold bending the mounts. Care must be taken to not exceed 5.00" width after widening.

The control arm mounts should be inspected for damage.

Both control arm bushings and mounting fasteners must be replaced in a control arm when bushings are serviced. ReycoGranning® recommends replacing the control arm bushings and mounting fasteners in all of the control arms at the same time.

The control arm housings must be properly supported during bushing removal. The bores of the control arm housings may be honed to remove any burrs.

If the control arm is to be separated from the steering knuckle, follow the removal and installation procedures in the "Replacing the Ball Joint" Section.

CAUTION: Use of a cutting torch to remove control arm bolts will permanently damage control arm bushings and can result in damage to subframe.

Preparation

1. Set the parking brake and block the drive wheels to prevent vehicle movement.

WARNING: Never work under a vehicle supported by only a jack. Jacks can slip or fall over and cause serious personal injury. Always use safety stands.

2. Raise the vehicle until the front wheels are off the ground. Support raised vehicle with safety stands. Do not place jacks or safety stands under the lower control arms to support the vehicle.

3. Remove the tires and check that the air springs are deflated.

Upper Control Arm

1. Disconnect height control valve linkage from the upper control arm. Follow the removal procedure in "Replacing the Height Control Valve" Section.

> ⚠ **WARNING: The steering knuckle is heavy and unevenly balanced. Use a portable crane or suitable jack to support it prior to disconnecting it from the control arm or removing the control arm with the steering knuckle attached.**

2. If desired, disconnect the upper control arm from the steering knuckle. Follow the removal procedure in "Replacing the Upper Ball Joint" Section.
3. Loosen and remove the control mount arm bolts. Remove any existing eccentric components. Note the orientation of the set screws for reinstallation.
4. Press the bushing out of the control arm housing. Be sure to properly support the housing.
5. Inspect the housing bores and remove any burrs in the housing by honing.
6. Press the bushing into the control arm housing. Be sure to properly support the housing.
7. Place the control arm in its mount location. If not equipped with eccentrics, install the control arm mount bolts into subframe snug tight and skip to step 15.
8. Place the spacer into the bushing.
9. Insert an eccentric adapter on each end of the upper control arm mounting plate.
10. Place bolt and washer through the spacer and bushing as shown.
11. Install washer and locking nut.
12. Repeat the process for the rear upper control arm mounting bolt.
13. Rotate the eccentric adapters on the front mounting bolt, such that the set screws are located as previously orientated.
14. Vehicle alignment may have to be checked. Please refer to Section 5. When the eccentric adapters are properly oriented, tighten the bolts.
15. Support the control arm such that it is at ride height and tighten the bolts to **950-1050 lbf•ft**. (without eccentrics) or **460-490 lbf•ft**. (with eccentrics). See Torque Table.
16. Install and tighten the set screw on any eccentrics installed to **30-40 lbf•in.** Refer to Torque Table.
17. Reconnect the steering knuckle to the control arm if disconnected. Follow the installation procedure in "Replacing the Upper Ball Joint" Section.
18. Reconnect the height control valve linkage. Follow the installation procedure in "Replacing the Height Control Valve" Section.

Lower Control Arm

1. Disconnect the lower shock mount from the lower control arm. Follow the removal procedure in "Replacing the Shock" Section.

WARNING: The steering knuckle is heavy and unevenly balanced. Use a portable crane or suitable jack to support it prior to disconnecting it from the control arm or removing the control arm with the steering knuckle attached.

2. If desired, disconnect the lower control arm from the steering knuckle. Follow the removal procedure in "Replacing the Lower Ball Joint" Section.
3. Loosen and remove the control mount bolts.
4. Press the bushing out of the control arm housing. Be sure to properly support the housing.
5. Inspect the housing bores and remove any burrs in the housing by honing.
6. Press the bushing into the control arm housing. Be sure to properly support the housing.
7. Place the control arm in its mount location. Install the control arm mount bolts into subframe snug tight.
8. Support the control arm such that it is at ride height and tighten the bolts to **950-1050 lbf•ft**. See Torque Table.
9. Reconnect the steering knuckle to the lower control arm if disconnected. Follow the installation procedure in "Replacing the Lower Ball Joint" Section.
10. Reconnect the lower shock mount. Follow the installation procedure in "Replacing the Shock" Section.

Replacing Wheel Bearings, Oil Seals, and Hub Caps

Preparation

1. Set the parking brake and block the drive wheels to prevent vehicle movement.
2. Raise the vehicle until the front wheels are off the ground. See jacking instructions. Support raised vehicle with safety stands. Do not place jacks or safety stands under the lower control arms to support the vehicle.

WARNING: Never work under a vehicle supported by only a jack. Jacks can slip or fall over and cause serious personal injury. Always use safety stands.

3. If the wheel nuts have chrome covers, remove them with special pliers equipped with plastic non-marring jaws. Place them in a container to prevent damage or loss.
4. On aluminum wheels, place a plastic anti-scuff guard over the wheel nuts and loosen the wheel nuts. On steel wheels, remove the hub cap nuts if present and the hub cap before loosening the wheel nuts. Place the hub cap in safe location to prevent damage. Place the wheel and/or hub cap nuts in a

container to prevent contamination or loss.

5. Remove the wheel and tire assembly and place it aside. Mark the tire to ensure it can be identified for installation on same side as removed.
6. Remove the brake drum and place it aside. Mark the brake drum to ensure it can be identified for installation on same side as removed.

Removal

1. Place an oil drip tub beneath the hub to catch oil. Rotate the hub such that the hubcap drain plug is facing upwards. Remove the drain plug from the hubcap and place it in a container for re-installation.
2. Rotate the hub such that the drain hole faces downward and drain the oil from hub cavity. Wait a few minutes for most of the oil to drain before continuing to the next step.
3. Remove the hub cap bolts, hub cap, and gasket. Take care not to damage the gasket for re-installation. Place the components in a location to prevent contamination. Note that the hub cap window may be damaged by solvents.

NOTE: When removing or installing the inner and outer spindle nuts, use the correct wrench sockets to avoid damaging the nuts. Do not use impact driver to tighten inner and outer nuts. Only use a torque wrench to tighten the nuts.

4. Unbend the spindle washer and remove the spindle outer nut, spindle washer, locking "D" washer, and the inner spindle nut. Retain all components for re-assembly except discard the spindle washer.
5. Place a shop towel on top of the lower brake shoe to prevent oil from dripping onto the brake lining.
6. Tug sharply on the hub to unseat the outer bearing without completely removing the hub. Wipe up any oil spilled on the brake assembly as quickly and completely as possible. Remove the outer bearing and place it in a container to prevent contamination.
7. Remove the hub from the spindle and place it on the floor with its stud side facing downwards. Protect the wheel studs from damage. Wipe the excess oil off spindle with a clean shop towel to prevent oil dripping onto the brake assembly. If oil saturates or significantly contaminates the brake lining then replace the lining.
8. Remove the hub seal and discard it. Inspect the axle ring on the spindle and remove it if worn.
9. Inspect the inner cup (outer bearing race for the inner bearing) and outer cup in the hub for damage. Replace the inner cup if damaged.

Section 6
Repair

Installation

1. Remove the axle ring from the replacement hub seal assembly P/N 7977 if the axle ring is not removed from the spindle. Note axle ring orientation. Place the hub seal onto the axle ring with the ribbed rubber side facing the flange of the axle ring. Seat the hub seal firmly against the axle ring flange. If the axle ring is removed, install the hub seal assembly with appropriate seal installation tool. (Reference Stemco P/N 555-5098)

NOTE: Do not drive bearing onto spindle with a steel hammer or similar instrument. Inner race is a tight slip fit with spindle.

2. Place the replacement inner bearing P/N 1784 onto spindle with small end of taper facing outward. Seat the inner race against the step of the spindle.
3. Press the ABS sensor outward about ¼". Do not use a sharp tool on lead wire end of the sensor. See section 3 for the inspection of ABS sensor as needed.
4. Place the hub onto the spindle until it seats on the inner bearing. Do not "ram" the hub onto the seal.
5. Place the replacement outer bearing onto the spindle until it seats on the outer cup in the hub. The inner spindle nut may be used to guide the bearing onto the spindle. The hub should be supported to prevent misalignment and binding.
6. Install the inner spindle nut and tighten hand tight.
7. Seat the bearings by tightening the inner spindle nut to **180 lbf•ft** while rotating the wheel in both directions.
8. Rotate the hub and drum ten (10) complete revolutions.
9. Loosen the inner spindle nut completely and then re-tighten the inner nut to **20 lbf•ft**.
10. Back off the inner spindle nut ¼ turn.
11. Install the spindle locking "D" washer.

NOTE: If the dowel pin of the inner spindle nut and a hole in the locking washer are not aligned, turn the locking washer over and re-install. If required, loosen the inner spindle nut just enough for alignment.

CAUTION: Never tighten the inner spindle nut to align the dowel pin with hole in locking washer. This can pre-load the bearings and cause premature bearing failure.

12. Install the replacement spindle washer P/N 6969 and the outer spindle nut. Tighten the outer spindle nut to **200-300 lbf•ft**. See Torque Table for sequence.
13. Attach a dial indicator with a magnetic base to the face of the hub. (See Figure 29). Note the brake drum is shown for reference only.

14. Place the tip of the dial indicator on the center of the steering knuckle spindle. Set the dial indicator on zero.

NOTE: Do not push/pull at the top and the bottom of the hub. Pushing or pulling at the top and the bottom will not yield a true measurement of the end play.

15. Measure the end play by simultaneously pushing/pulling on each side of the hub while observing the dial indicator. The end play is the *total* travel observed. If the end play is not within .001-.004 inch re-adjust the wheel bearings per steps 7-11. Otherwise continue to step 16.

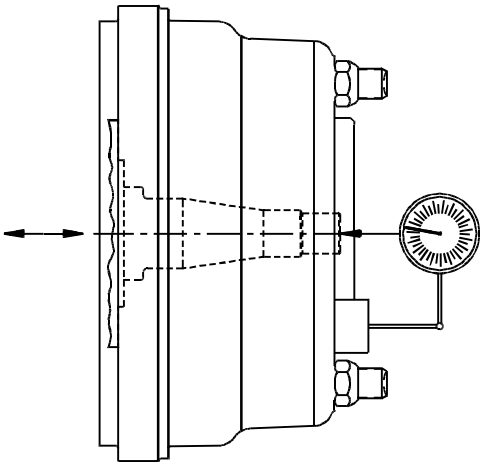


Figure 29 - Wheel End Play Measurement

16. Bend the spindle washer over one wrench flat of the outer nut.
17. Install the hub cap gasket and hub cap. Tighten the cap screws to **20-30 lbf•ft**. See Torque Table for sequence.
18. Fill the hub cavity with the appropriate amount(approx ½ pint) and type of lubricant(90W gear oil).
19. Check oil level through the hub cap window. (See Figure 30). If level is below the "add" level line, then fill with recommended oil until "full" level is achieved. Add oil slowly since the heavy weight oil will settle slowly in the hub. (Note: The hub cap window can only be cleaned with mild soap and water. Aromatic solvents should not be used as they will impair the transparency of the window.)

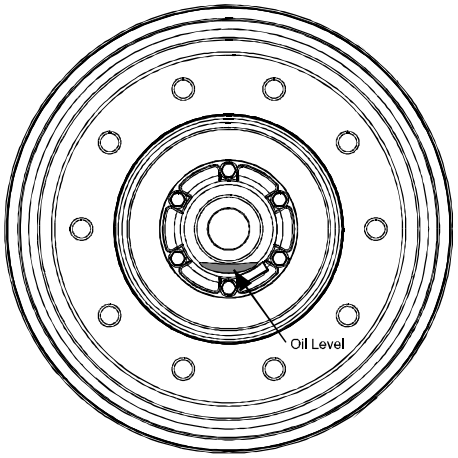


Figure 30 - Wheel Bearing Oil Level

20. Install the hub cap drain plug.
21. Check the hub cap for external oil leakage at the drain plug or gasket. For leaks at the drain plug check for application of thread sealant to threads and tightness. For leaks at the gasket, replace the gasket. The vent plug will normally weep a small amount of oil.
22. Install the brake drum.

23. Install the wheel and tire assembly and the wheel nuts.
24. On aluminum wheels, use a plastic anti-scuff guard over the wheel nuts. Tighten the wheel nuts to **450-500 lbf•ft**. See Torque Table for sequence.
25. Replace the hub cap nuts and hub caps if removed to service the wheel bearings.
26. Remove jack stands and jacks

Replacing Brake Components

Brake Drums

The brake drums should be replaced if they are damaged or exceed the drum manufacturers recommended maximum diameter or runout specification. Refer to manufacturer brake drum guidelines for inspection and specifications.

Automatic Slack Adjuster

The automatic slack adjusters are not serviceable and should be replaced if damaged or malfunctioning. Refer to manufacturer guidelines for correct function of the automatic slack adjuster.

Brake Chambers

The brake air chambers should be replaced if damaged or malfunctioning. Refer to manufacturer guidelines for correct function of the brake air chambers.

Other Brake Components

The brake shoe linings should be replaced when they are worn beyond the manufacturers limits. When the brake linings are serviced, other components such as the S-cam rollers and return springs should also be serviced. Refer to the brake manufacturers guidelines for servicing the brakes.

Replacing the ABS Sensor and Tone Ring

The anti-lock brake system(ABS) of the vehicle should be diagnosed by a qualified technician before the anti-lock brake sensor or the tone ring are replaced. Replacement parts must be equivalent to the vehicle manufacturers to ensure proper function of the anti-lock brake system. The anti-lock brake sensor and tone ring cannot be repaired and must be replaced if damaged or malfunctioning.

Preparation

1. Set the parking brake and block the drive wheels to prevent vehicle movement.
2. Raise the vehicle until the front wheels are off the ground. Support raised vehicle with safety stands. Do not place jacks or safety stands under the lower control arms to support the vehicle.

WARNING: Never work under a vehicle supported by only a jack. Jacks can slip or fall over and cause serious personal injury. Always use safety stands.

3. Remove the tires and check that the air springs are deflated.

Sensor Removal

1. Remove the brake drum to provide access to sensor.
2. Press sensor out of steering knuckle. Do not pull sensor out by its lead wire.

3. Remove tie straps that secure the sensor lead wire and disconnect the sensor lead wire from the chassis.

Sensor Installation

1. Check that the sensor bushing is properly seated in the steering knuckle and the sensor spring retainer is seated properly in the sensor bushing.
2. Press the sensor into the steering knuckle until the sensor end contacts the tone ring.
3. Connect a volt meter to the connector pins of the sensor lead wire. Set the volt meter to read AC voltage on a scale of 1V-10V.
4. Spin the hub by hand and read the voltage output of the sensor. A minimum reading of .8V AC is normal. Skip to step 8 if minimum reading is obtained.
5. If the minimum reading is not obtained then check the volt meter connection and proximity of the sensor and tone ring. The air gap between the sensor and tone ring should not exceed .027". Repeat step 4.
6. If the minimum reading is not obtained, check the tone ring for damage and its installation. The tone ring should have a maximum runout of .008". Replace as needed and repeat step 4.
7. If the minimum reading is still not obtained, then replace the sensor and repeat the installation procedure.
8. Route and secure the sensor lead wire the same as the removed sensor.
9. Connect the sensor lead wire to the chassis.
10. Install the brake drum and tires.

Tone Ring

Follow the hub manufacturers guidelines for removal and installation of the tone ring.

Replacing the Rebound Bumper Stop

Both of the rebound bumper stops should be replaced at the same time if service on one bumper is required.

Preparation

1. Set the parking brake and block the drive wheels to prevent vehicle movement.
2. Deflate the suspension to provide access.

Removal

1. Turn the tire to provide access.
2. Remove mounting fasteners and the rebound bumper stop.

Installation

1. Install the rebound bumper stop and mounting fasteners.
2. Tighten the bolt head to **25-30 ft-lbs**. See Torque Table.

Replacing the Shock Absorber

CAUTION: The shock absorber is gas pressurized and must not be punctured or be subjected to excessive heat which can result in serious personal injury.

Preparation

NOTE: The outer tie rod may need to be temporarily removed from the bell crank and/or idler arm for access to the lower shock absorber mount. Please refer to the Replacing the Relay Rod and Outer Tie Rod section for the proper procedure.

1. Set the parking brake and block the drive wheels to prevent vehicle movement.

Note: Early models of the IFS1200 suspension were equipped with shock absorber mounting studs. Subsequent IFS1200 suspensions and all IFS1320 models utilized through bolts.

Removal (Stud Mount Version)

1. Remove the upper and lower 3/4-10 lock nuts which secure the shock eye to the shock mount stud. The shock mount stud should be held such that it is not loosened from its mount.
2. Remove the upper and lower outer retaining washers from the shock mount studs. Note the orientation of the retaining washers.

⚠ **WARNING: The shock absorber is gas pressurized and should be restrained from expansion during removal and installation.**

3. Dislodge the upper and lower shock eye from the shank portion of the shock mount stud and pry the outer shock eye bushing from the eye. Discard the bushing.
4. Pry the inner shock eye bushing from the eye and remove the shock absorber. Discard the bushing.

Installation

1. Check that the upper and lower shock mount studs are properly tightened. The lower stud should be tightened at **200-225 lbf•ft**. If the lower shock mount stud was loosened from the lower control arm(LCA) during shock removal, then remove the stud from the LCA, apply Loctite #242(or equivalent) to the threads which thread into the LCA, and torque to **200-225 lbf•ft**. The upper flange lock nut(3/4-10) should be tightened to **200-225 lbf•ft**. If the upper shock mount stud was loosened from the subframe during removal, then re-torque to **200-225 lbf•ft**. See Torque Table.
2. Place the inside retaining washers, shock sleeves, and the inside shock eye bushings on the upper and lower shock mount. Note the orientation of the washer and bushing. (See Figure 31).
3. Install the shock on the shock mounts.
4. Place the outside shock eye bushings and the outside retaining washers on the upper and lower shock mount. Note the orientation of the washer and bushing. (See Figure 31).
5. Install the upper and lower 3/4-10 lock nuts and tighten to **90-110 lbf•ft**. See Torque Table.

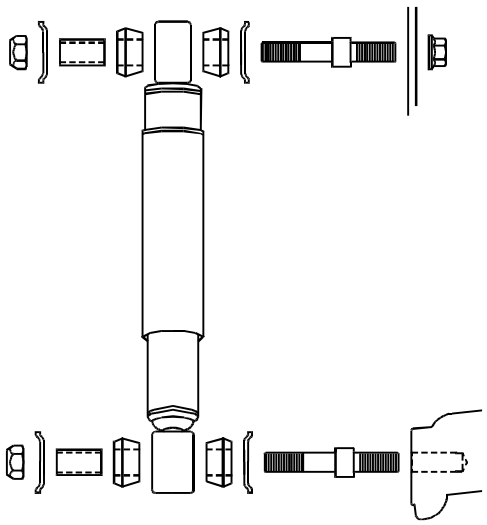


Figure 31 - Shock Absorber Mount

Removal (Bolt Mount Versions)

1. Loosen and remove the 3/4-10 lower shock absorber mount bolt from the lower control arm.
2. Loosen and remove the 3/4-10 upper shock absorber mount bolt from the nut.

> ⚠ **WARNING: The shock absorber is gas pressurized and should be restrained from expansion during removal and installation.**

Installation

1. Apply Loctite #242(or equivalent) to the threads of the lower shock absorber mount bolt.
2. Install the bolt into the lower mount of the shock. (Refer to Figure 32).
3. Thread into the LCA, and torque to **170-190 lbf•ft**. See Torque Table.
4. Reinstall the upper mount of the shock absorber using the 3/4-10 bolt and lock nut. Refer to Figure 30.
5. Torque the bolt to **170-190 lbf•ft.** See Torque Table.

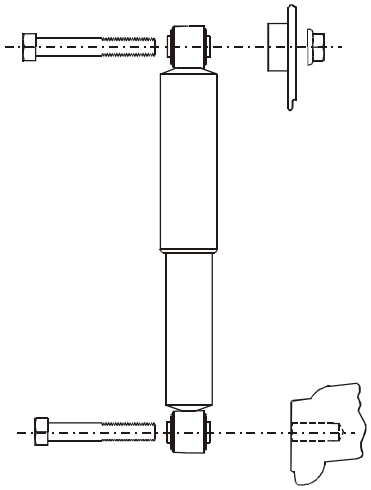


Figure 32 - Shock Absorber Mount

Replacing the Air Spring

When replacing the air spring be sure that the correct replacement air spring is installed. The use of a substitute air spring that is not recommended by Granning may cause unequal load sharing between the air springs which may be detrimental to vehicle ride and handling.

Preparation

1. Set the parking brake and block the drive wheels to prevent vehicle movement.
2. Raise the vehicle until the front wheels are off the ground. Support raised vehicle with safety stands. Do not place jacks or safety stands under the lower control arms to support the vehicle.

WARNING: Never work under a vehicle supported by only a jack. Jacks can slip or fall over and cause serious personal injury. Always use safety stands.

3. Deflate the air springs.

Removal

1. Disconnect the air line at the air spring and remove the connection fitting.
2. Remove the nuts and washers from the upper air spring mount studs. See Figure 33.
3. Remove the bolts that secure the air spring to the lower control arm. See Figure 34.
4. Remove the air spring.

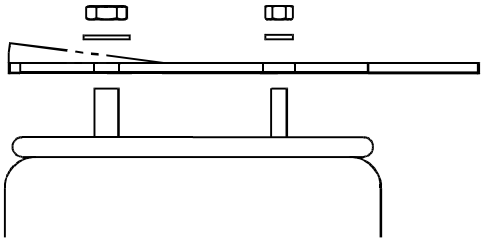


Figure 33 - Air Spring Upper Mount

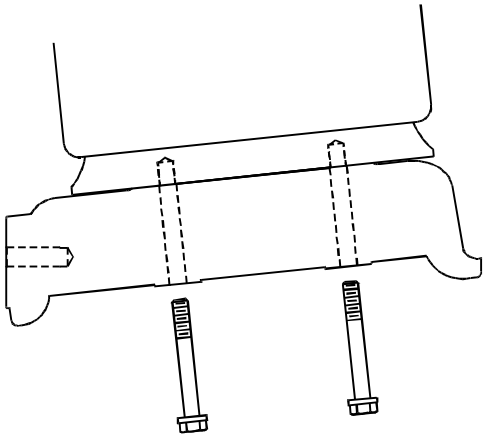


Figure 34 - Air Spring Lower Mount

Installation

1. Assemble the air spring to the lower control arm. Tighten the bolts to **30-40 lbf•ft**. See Torque Table.
2. Assemble the nuts and washers that connect the air spring to the upper air spring mount on the subframe. Tighten the nuts to **30-40 lbf•ft**. See Torque Table.
3. Install the connection fitting into the air spring. Use Permatex or equivalent thread sealant.
4. Connect the air line to the air spring.
5. Lower the vehicle frame and inflate the air springs.
6. Check the air fittings for leaks.

Replacing the Steering Damper

Preparation

1. Set the parking brake and block the drive wheels to prevent vehicle movement.

Removal

1. Remove the mounting nuts from each end of the steering damper.
2. Remove the steering damper.

Installation

1. Install the steering damper in the subframe and relay rod bracket mounts.
2. Tighten the mounting nuts. See Torque Table.

Section 6
Repair

Replacing the Suspension Subframe

When replacing the suspension subframe use the proper size and grade fasteners. The subframe may be removed from and installed to the chassis frame with suspension fully assembled.

Preparation

1. Set the parking brake and block the drive wheels to prevent vehicle movement.
2. Raise the vehicle until the front wheels are off the ground. Support raised vehicle with safety stands. Do not place jacks or safety stands under the lower control arms or the suspension subframe to support the vehicle.

> ⚠ **WARNING: Never work under a vehicle supported by only a jack. Jacks can slip or fall over and cause serious personal injury. Always use safety stands.**

3. Remove the tires and deflate the air springs.

Removal

1. Disconnect the drag link.
2. Disconnect the air lines to the height control valves and brakes.
3. Disconnect the ABS sensor lead wire.
4. Support the bottom of the subframe with a suitable jack or lift mechanism.
5. Remove fasteners connecting the subframe to the chassis frame rail.
6. Lower the subframe from the chassis frame rails and remove from the chassis.
7. Remove all other suspension components from the subframe. See the appropriate section for removal of each component.

Installation

1. Install all other suspension components to the subframe. See the appropriate section for installation of each component.
2. Place the subframe under the chassis and raise it into location on the chassis frame rails.
3. Connect the subframe to the chassis frame rails. Tighten the fasteners to recommended torque of chassis manufacturer. Reconnect the ABS sensor, air lines, and drag link.

Replacing the Height Control Valve

When replacing the height control valve (HCV) be sure that the correct replacement HCV is installed (see Section 3, Height Control Valve Inspection). The use of a substitute HCV that is not recommended by ReycoGranning® may cause unequal load sharing between the air springs which may be detrimental to vehicle ride and handling.

Preparation

1. Set the parking brake and block the drive wheels to prevent vehicle movement.
2. Raise the vehicle until the front wheels are off the ground. Support the raised vehicle with safety stands. Do not place jacks or safety stands under the lower

control arms to support the vehicle.

> **WARNING: Never work under a vehicle supported by only a jack. Jacks can slip or fall over and cause serious personal injury. Always use safety stands.**

3. Deflate the air springs.

Removal

1. Mark air line connections for re-assembly. Disconnect the air lines from the HCV. If any other plumbing fixtures are connected to the HCV, mark them for re-assembly.
2. Disconnect the vertical link from the upper control arm.
3. Remove the mounting bolts, nuts, washers, and HCV from the subframe.
4. Remove any other plumbing fixtures from the HCV.

Installation

1. Assemble the actuation arm and the vertical link of the replacement HCV the same as the removed HCV. For Ridewell HCV's, note the orientation of the actuation arm at the pivot mount.
2. For Ridewell HCV's only: Trim the lengths of the linkages of the replacement HCV to be the same as the removed HCV. Tighten the set bolt and clamp screw to **8-12 lbf•ft.** See Torque Table.
3. Assemble any other plumbing fixtures to the HCV as marked for re-connection.
4. Mount the replacement HCV to the subframe with bolts, nuts, and washers. Tighten the nuts to **10-15 lbf•ft.** See Torque Table.
5. Reconnect air lines and check for proper operation and leaks.
6. Check and adjust ride height per Adjusting Suspension Ride Height Section.

Section 6
Repair

Replacing the Sway Bar

WARNING: Never work under a vehicle supported by only a jack. Jacks can slip or fall over and cause serious personal injury. Always use safety stands.

Preparation

1. Set the parking brake and block the drive wheels to prevent vehicle movement.
2. Removal and replacement of the sway bar is best done while the suspension is at ride height to remove all loading from the sway bar. It is recommended that this service be performed in a service environment that provides access to the undercarriage while at ride height (such as a pit or full vehicle lift).

Removal

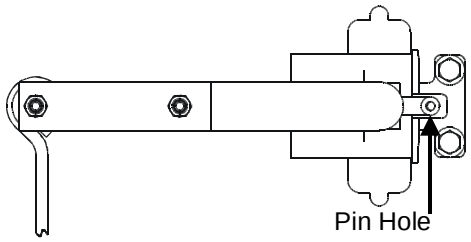
1. Disconnect the height control arm from the sway bar.

WARNING: It is recommended to secure the height control valve arm such that the valve will not "dump" air while the sway bar is being replaced.

2. Remove the bushing brackets.
3. Remove the sway bar. Note orientation of sway bar ends.
4. Remove the sway bar bushings from the bar.
5. Inspect bushings for any damage.

Installation

1. Lubricate the bushings' inner diameter with Aqua Shield Grease (TC1920).
2. Install the two split bushings over the sway bar.
3. Install the bar to the suspension. Note: The ends of the sway bar should tip up on the lower control arms.
4. Install the two bushing brackets over the split bushings. Torque the fasteners to 52 lbf•ft. See torque table.
5. Lubricate the two non-split bushings.
6. Install these two bushings over the ends of the bar.
7. Install the two bushing brackets over the remaining two bushings. Torque to 52 lbf•ft. See torque table.
8. Loosely install the height control arm to the sway bar.



9. Set the height control valve arm (on the valve) to level. It is recommended to use the wood dowel through the pin hole located in back of the height control valve.
10. Tighten the retaining U-bolts to the sway bar to 20-30 lbf•ft. See torque table.
11. Remove the wood dowel if necessary.

Section 7
Torque Specifications

TORQUE SPECIFICATIONS

Most threaded fasteners are covered by specifications that define required mechanical properties, such as tensile strength, yield strength, proof load, and hardness. These specifications are carefully considered in initial selection of fasteners for a given application. To assure continued satisfactory vehicle performance, replacement fasteners used should be of the correct strength, as well as the correct nominal diameter, thread pitch, length, and finish.

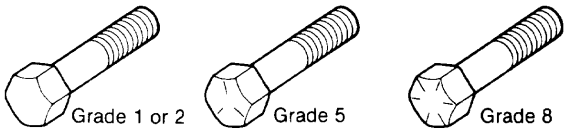


Figure 35: Grade Markings on Bolts

Grade	Lock Nut Grade B, F	Lock Nut: Grade C, G
Identification	3 Dots	6 Dots

Figure 36: Grade Markings on Lock Nuts

Torque Table 1

APPLICATIONS	FASTENER SIZE	TORQUE SPECIFICATION (LBF•FT.) (CLEAN AND DRY)
Lower Control Arm Bushing Pivot Bolt	1-1/8-12 Grade 8	950-1050(1)
Upper Control Arm Bushing Pivot Bolt (without Eccentric Adapters)	1-1/8-12 Grade 8	950-1050(1)
Upper Control Arm Bushing Pivot Bolt (with Eccentric Adapters)	7/8-9 Grade 8	460-490(1)
Eccentric Set Screw	#10-24x3/8	30-40 lbf.-in.
Upper Ball Joint Base	M56x1.5	325-375(2)
Upper Ball Joint Retention Clip SHCS	1/4-28	15-20
Upper Ball Joint Ball Stud Castle Nut	M20x1.5	155-170(3)
Lower Ball Joint Base	M85x1.5	525-575(2)
Lower Ball Joint all Stud Castle Nut	M30x1.5	330-370 (3)
Air Spring Upper Mount Nut	3/4-16 Grade 5 1/2-13 Grade 5	30-40 30-40
Air Spring Lower Mount Bolts	1/2-13 Grade 5	30-40 (1)
Upper Shock Stud Mount Flange Lock Nut (stud version)	3/4-10 Grade G	200-225
Upper Shock Eye Mount Lock Nut (stud version)	3/4-10 Grade C	90-110
Lower Shock Stud Mount (stud version)	3/4-10 Grade 8	200-225(2)
Lower Shock Eye Mount Locknut (stud version)	3/4-10 Grade C	90-110
Upper Shock Mount Lock Nut (bolt version)	3/4-10 Grade C	170-190
Lower Shock Mount Bolt (bolt version)	3/4-10 Grade 8	170-190(2)
Rebound Bumper Mount Flange Lock Nut	5/16-18 Grade G	25-30
Steering Damper Mount Nut		Tighten only enough so that bushing is expanded to the diameter of the outer retaining washer.
Steering Arm Mount Lock Nut	7/8-9 Grade C	350
Steering Stop Jam Nut	5/8-11 Grade 5	90-110
Tie Rod and Drag Link Length Adjustment Nuts	1-1/8-12 1-1/4-12	110-130 110-130
Outer Tie Rod, Relay Rod, & Drag Link Ball Stud Castle Nuts (Except at Pitman Arm Connection)	7/8-14	130-150 (3)
Drag Link Ball Stud Castle Nut at Pitman Arm Connection	7/8-14	120-170 (3)
Subframe to Chassis Mount Flange Lock Nut	1/2-13 Grade G	90-100
Height Control Valve Body Mount Lock Nut	1/4-20 Grade C	9
Height Control Valve Linkage Stud Mount Nut	1/4-20 Gr. 5	60-80

1) Torque applied to bolt head.
2) Apply thread adhesive Loctite #242 or equivalent to threads of fastener threaded into tapped hole.
3) Install cotter pin after tightening.

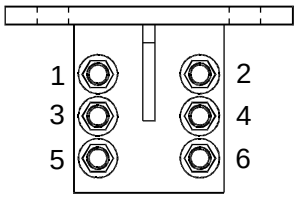
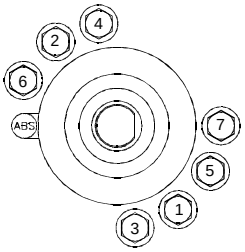
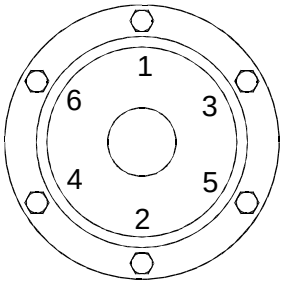
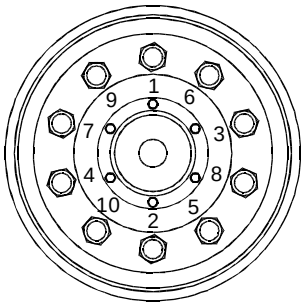
Section 7
Torque Specifications

Torque Table 1 (Cont)

APPLICATIONS	FASTENER SIZE	TORQUE SPECIFICATION (LBF•FT.) (CLEAN AND DRY)
Height Control Valve Control Arm Pivot Set Bolt	5/16-18 Grade 2	60-80 lbf.-in.
Height Control Valve Linkage Clamp Screw		Tighten clamp until rod is tight.
Spindle Inner Nut	1-1/2-12	See Section 5 Adjusting the Wheel Bearings
Spindle Outer Nut	1-1/2-12	200-300
Height Control Valve Arm, Sway Bar Mount	3/8-24 Gr. 8	20-30
Sway Bar Bushing Mount	7/16-14 UNC Gr. 8	52

1) Torque applied to bolt head.
2) Apply thread adhesive Loctite #242 or equivalent to threads of fastener threaded into tapped hole.
3) Install cotter pin after tightening.

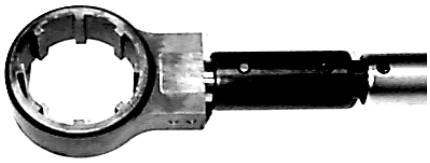
Torque Table 2

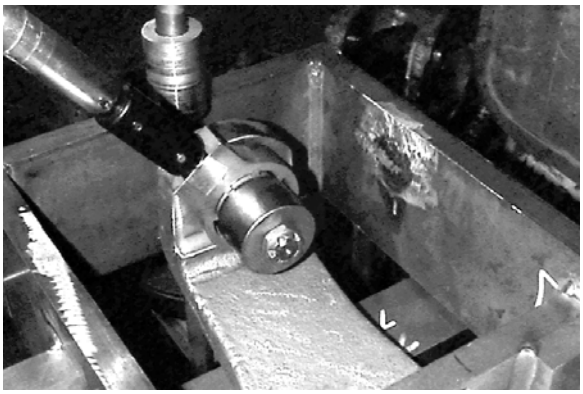
APPLICATIONS	FASTENER SIZE	TORQUE SPEC. (LBF•FT.) (CLEAN AND DRY)	TORQUE SEQUENCE
Steering Damper Tie Rod Mount Lock Nut	3/8-24 Grade 5	25-30	
Brake Spider Mount Cap screw	5/8-18 Grade 8	170-190(1 & 2)	 Driver Side
Hub Cap Bolt	5/16-18 Grade 5	20-30(1)	
Wheel Nut	1-1/8-16 (Stud Piloted) M22x1.5 (Hub Piloted)	450-500(3) (Dry Threads)	

1) Torque applied to bolt head.
2) Apply thread adhesive Loctite #242 or equivalent to threads of fastener threaded into tapped hole.
3) Recheck wheel nut torque after first 50-100 miles.

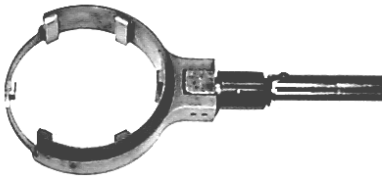
Section 8
Special Ball Joint Tools

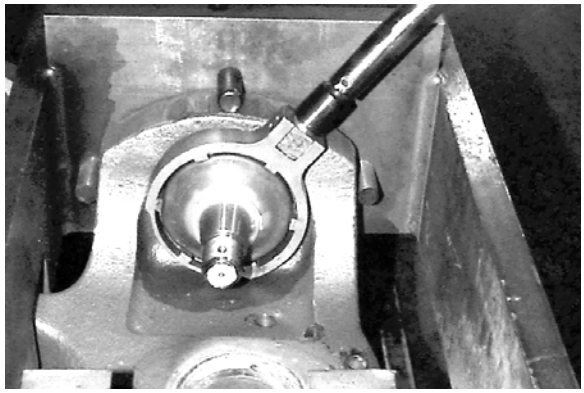
To install or remove upper and lower ball joints, ReycoGranning® Air Suspensions recommends the use of the following special tools:



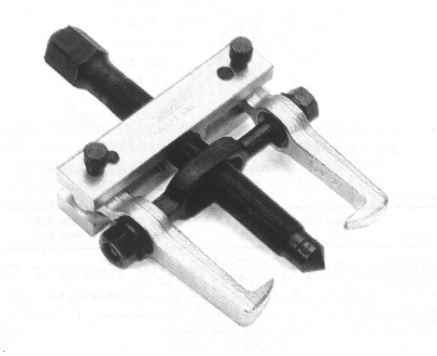


Upper Ball Joint Special Tool, Part Number: A7250A.





Lower Ball Joint Special Tool, Part Number: A7250B.



Recommended Ball Joint Puller,

Snap-On Bar-Type “CJ” Pullers, 4-3/8” Jaws,
3/4”-16x4-1/4” Pressure Screw, 3-1/2” to 6” Yoke

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